

CA1

MS

- 42R52



3 1761 11767451 5

~~Gov.Doc.
Can
Com
S~~

Canada. St. Mary and Milk
Rivers Water Development
Committee

Report on further storage
and irrigation works required
to utilize fully Canada's
share of international streams
in southern Alberta. 1942.

[Commissions and
Committees of Inquiry]

Gov. Doc.
Can
Com
S

Canada,
ST. MARY AND MILK RIVERS WATER
DEVELOPMENT COMMITTEE

REPORT

ON

FURTHER STORAGE AND IRRIGATION
WORKS REQUIRED TO UTILIZE FULLY
CANADA'S SHARE OF INTERNATIONAL
STREAMS IN SOUTHERN ALBERTA



OTTAWA
EDMOND CLOUTIER
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1942

Price, 50 cents

NOV 27 1942

ST. MARY AND MILK RIVERS WATER
DEVELOPMENT COMMITTEE

REPORT

ON

FURTHER STORAGE AND IRRIGATION
WORKS REQUIRED TO UTILIZE FULLY
CANADA'S SHARE OF INTERNATIONAL
STREAMS IN SOUTHERN ALBERTA

MEMBERS OF COMMITTEE

- VICTOR MEEK, (Chairman)
Controller, Dominion Water and Power Bureau, Ottawa.
Designated by the Minister of Mines and Resources.
- GEORGE SPENCE,
Director of Prairie Farms Rehabilitation, Regina.
Designated by the Minister of Agriculture.
- WILLIAM E. HUNTER,
Accounts Branch, Department of Finance, Ottawa.
Designated by the Minister of Finance.

MEMBERS OF THE ALBERTA WATER
DEVELOPMENT COMMITTEE

- (Designated by the Government of Alberta to work
with the Federal Committee)
- Hon. D. B. MacMILLAN, (Chairman)
Minister in Charge of Water Resources and
Irrigation, Edmonton.
- Hon. N. E. TANNER,
Minister of Lands and Mines, Edmonton.
- P. M. SAUDER, Secretary.
Director of Water Resources, Edmonton.

FEBRUARY, 1942.

OTTAWA, CANADA.

ST. MARY AND MILK RIVERS WAYNE
DEVELOPMENT COMMITTEE
REPORT
FUTURE STUDY AND REVISION
WORKS REPORT TO THE
CIVIL ENGINEERING
SIXTH FLOOR
Digitized by the Internet Archive
in 2023 with funding from
University of Toronto

OTTAWA, February 16, 1942.

The Honourable T. A. CRERAR,
Minister of Mines and Resources,
Ottawa.

SIR,—The St. Mary and Milk Rivers Water Development Committee named by Order in Council P.C. 682, dated February 17, 1941, to make a thorough study of the further works required to utilize fully Canada's share of the St. Mary and Milk Rivers in Alberta, has the honour to transmit its Final Report herewith.

Respectfully submitted,

VICTOR MEEK, Chairman,
*Controller, Dominion Water and Power
Bureau, Ottawa. Designated by the
Minister of Mines and Resources.*

GEORGE SPENCE,
*Director of Prairie Farms Rehabilitation,
Regina. Designated by the
Minister of Agriculture.*

WILLIAM E. HUNTER,
*Accounts Branch, Department of
Finance, Ottawa. Designated by
the Minister of Finance.*

CONTENTS

	PAGE
LETTER OF TRANSMITTAL.....	iii
INTRODUCTION.....	1
FINDINGS.....	2
RECOMMENDATIONS.....	4
Suggested Distribution of Costs.....	4
General Recommendations.....	6

PART I

INTRODUCTION.....	7
Meetings.....	7
Projects Visited.....	7
Acknowledgments.....	8
References.....	9
Composition of Report.....	9
SYNOPSIS.....	9
International Features.....	9
Water Supply Available and Apportionment of St. Mary and Milk Rivers.....	11
Irrigation Development for Use of St. Mary and Milk Rivers in United States.....	11
Irrigation Development for Use of St. Mary and Milk Rivers in Canada.....	12
Total Water Available to Canada from St. Mary, Milk, Belly, and Waterton Rivers..	12
Existing Irrigation Development in Alberta.....	13
Economic Value and Benefits of Proposed Development.....	14
Description of Area of Proposed Development.....	15
Plan of Ultimate Development.....	16
Construction Program Proposed.....	17
Legislation and Agreements.....	17
Colonization and Re-Establishment.....	18

PART II

INTERNATIONAL FEATURES.....	19
St. Mary River Drainage Basin.....	19
Milk River Drainage Basin.....	19
Belly River Drainage Basin.....	20
Waterton River Drainage Basin.....	21
Events Leading to Boundary Waters Treaty.....	21
Article VI of Boundary Waters Treaty.....	22
Controversy over Interpretation of Article VI.....	22
Action of International Joint Commission.....	23
Final Order of International Joint Commission dated October 4, 1921.....	23
Application of United States to Amend Order.....	26
Recommendations of International Joint Commission Regarding Storage.....	26
WATER SUPPLY AVAILABLE AND APPORTIONMENT OF ST. MARY AND MILK RIVERS.....	27
Apportionment and Use of St. Mary River.....	27
Apportionment and Use of Milk River.....	28
Combined Flow of Milk and St. Mary Rivers.....	29
IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN UNITED STATES..	29
History and Extent of Milk River Project in United States.....	29
Irrigation Development.....	30
Finances.....	31
Proposed Extension Milk River Project.....	31
Economic Feasibility.....	32
Summary of Development in United States.....	33

	PAGE
IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN CANADA.....	33
History and Description of Alberta Railway and Irrigation Company.....	34
Taber Irrigation District.....	35
Magrath Irrigation District.....	36
Raymond Irrigation District.....	36
Total Area Irrigated from the Alberta Railway and Irrigation System.....	37
Cost of Construction and Methods of Financing.....	37
Extent to which Canada uses Its Share of Milk and St. Mary Rivers.....	37
Deficiency of Water Supply on Existing Projects and Need for Storage.....	37
Hydrographs of Canada's share of St. Mary River.....	39
Water Supply Available for Further Development.....	40
Effect of Diversions on the South Saskatchewan River.....	40
HISTORY OF ADJOINING IRRIGATION PROJECTS.....	41
Eastern Irrigation District.....	42
Canada Land and Irrigation Company Project.....	43
Lethbridge Northern Irrigation District.....	44
Mountain View Irrigation District.....	46
Leavitt Irrigation District.....	47
United Irrigation District.....	48
ECONOMIC VALUE AND BENEFITS OF IRRIGATION TO EXISTING PROJECTS AND PROPOSED DEVELOPMENTS.....	50
Financial Difficulties in Connection with Irrigation.....	54
Economic Conditions.....	54
Too Much Wheat.....	55
Preparation of Land for Irrigation.....	55
Inexperience of Early Irrigators.....	56
Failure of Policy of Charging Entire Capital Cost of Construction to Lands Made Irrigable.....	56
Financial Returns from Different Types of Irrigation Farming.....	57
Amount of Construction Costs that Could be Recovered from Farmer.....	60
Annual Payments on Existing Projects.....	61
Findings of Ewing Commission.....	63
Basis of Annual Payments.....	64
Value of Proposed Development as a Post-War Undertaking.....	65
Annual Saving to Public Treasury by the Removal of Farmers from Submarginal Lands.....	65
Other National Benefits.....	66
Distribution of Benefits.....	69
DESCRIPTION OF THE PHYSICAL FEATURES OF THE AREA.....	70
Topography.....	70
Climate.....	70
Soils.....	71
Crops Grown.....	72
Livestock Statistics.....	72
Population.....	73
Agricultural and Direct Relief.....	73
Value of Dry Land in Area of Proposed Extension.....	73
PLAN OF ULTIMATE DEVELOPMENT.....	74
General Plan of Development.....	74
Suitability of New Lands.....	75
St. Mary Reservoir.....	77
Ultimate Irrigable Area.....	77
Construction Cost.....	77
Total Capital Cost.....	78
Operation and Maintenance.....	79
Power Development.....	80
CONSTRUCTION PROGRAM PROPOSED.....	80
Order of Development and Period Required for Completion.....	80
St. Mary Reservoir.....	81
Lands to be Included in First Development.....	82
Main Canals and Secondary Reservoirs.....	82
Proposed Construction Program with Estimated Yearly Expenditures.....	83
Organization Required.....	85
LEGISLATION AND AGREEMENTS.....	86
Legislation.....	86
Agreements.....	86
COLONIZATION AND RE-ESTABLISHMENT.....	87

TABLES

- I. Flow Record of the St. Mary River—United States' Share and Utilization.
- II. Flow Record of the St. Mary River—Canada's Share and Utilization.
- III. St. Mary and Milk Rivers—United States' and Canada's Share at International Boundary.
- IV. St. Mary and Milk Rivers—United States' Total Share and Utilization.
- V. St. Mary and Milk Rivers—Canada's Total Share and Utilization.
- VI. Deficiency of Water Supply from St. Mary River for Existing Irrigation Projects.
- VII. Estimate of Operation and Maintenance Costs during Development Period.
- VIII. Population in Areas of Proposed St. Mary and Milk Rivers Development.
- IX. Irrigation Development in Alberta—List of Irrigation Projects and Districts in Alberta showing Total Areas Irrigated from Existing Works.

APPENDICES

- A. Text of the Order in Council, P.C. 682, Setting Up the St. Mary and Milk Rivers Water Development Committee.
- B. List of Persons who attended one or more of the Meetings held by the Committee.
- C. Summary of Relief Expenditures, Saskatchewan and Alberta.
- D. Provincial Legislation for Setting Up Irrigation Districts.
- E. History of Irrigation—Mr. D. W. Hays.
- F. General Plan of the Proposed St. Mary and Milk Rivers Development Showing Sources of Water Supply, Reservoirs, Main Canals and Irrigable Lands.

REPORT OF THE ST. MARY AND MILK RIVERS WATER DEVELOPMENT COMMITTEE

INTRODUCTION

The St. Mary and Milk Rivers Water Development Committee was established by authority of Order in Council P.C. 682 of February 17, 1941 (See Appendix A), to make a thorough study of additional works required to utilize fully the share of the St. Mary and Milk Rivers apportioned to Canada by the International Joint Commission in its Order of October 4, 1921, and, without limiting the generality of its studies, the Committee was requested to give specific consideration to the following matters:—

- (a) The water supply in Canada's share of international streams in southern Alberta, the water requirements of the presently constructed projects, and water available for further irrigation development.
- (b) The most feasible plan to put these waters to beneficial use, including selection of lands to be irrigated, estimates of cost of storage reservoirs and other works required for complete development.
- (c) Construction program with annual estimated expenditure over the period of years required to complete full development.
- (d) The arrangements necessary with the owners of the present irrigation projects and the owners of the further lands to be irrigated.
- (e) The benefits which this water development would confer on Canada, the Province of Alberta, and the residents of the districts affected.
- (f) The allocation of costs and methods of financing.
- (g) The administrative control to be exercised over the projects after completion, including maintenance and operation of the works constructed and colonization of the irrigable lands.

Following numerous meetings, inspections, investigations, and consultations with provincial and other interests extending over the past year, the Committee has completed its studies and presents its report herewith. For the sake of immediate reference the Committee's findings and recommendations are presented first. Following this, the report is divided into two parts. Part I deals with the establishment of the Committee, outlines its activities, and presents in summary form the factual data which were gathered. Part II comprises a detailed presentation of data together with appendices.

FINDINGS

Based on the factual data summarized in Part I and outlined in more detail in Part II and Appendices, the Committee finds:

1. That the apportionment of the waters of the St. Mary and Milk Rivers is governed by a treaty between Great Britain and the United States dated January 11, 1909, and is under the direction of the International Joint Commission.
2. That a Final Order of the International Joint Commission dated October 4, 1921, provided definite rules for apportioning the waters and the application of priorities.
3. That for the period 1922 to 1940 inclusive, the share of the St. Mary and Milk Rivers allocated to Canada under the 1921 Order of the Commission averaged—St. Mary River, 362,000 acre-feet per year; Milk River, 40,000 acre-feet per year.
4. That during the period 1922 to 1940 Canada has constructed irrigation works capable of using on the average only 163,000 acre-feet per year of its share of the St. Mary River and not more than 2,000 acre-feet per year of its share of the Milk River.
5. That for the same period the share of the St. Mary and Milk Rivers allocated to the United States under the 1921 Order of the International Joint Commission averaged—St. Mary River, 249,000 acre-feet per year; Milk River, 75,000 acre-feet per year.
6. That as at the end of 1940 the United States had constructed storage and irrigation works capable, except in periods of unusual precipitation, of regulating and making available for use its entire share of the waters of the St. Mary and Milk Rivers. These works are also capable of storing within the United States that portion of Canada's share of the waters of the Milk River for which regulating and storage works have not yet been constructed in Canada.
7. That Canada should construct at an early date the necessary irrigation works to protect by beneficial use its share of the St. Mary and Milk Rivers.
8. That there have been acute shortages in the water supply for existing projects served by the St. Mary River in Canada and that upon completion of the proposed St. Mary Reservoir sufficient water would be available to supply these shortages and serve an additional area of 94,000 acres of new land.
9. That there is tributary to the St. Mary and Milk Rivers a larger area of good irrigable land than can be irrigated by the total water available from Canada's share of these rivers supplemented by waters of the Belly and Waterton Rivers.
10. That upon the completion of the ultimate development a total of 345,000 acres would be available for post-war settlement and for the re-establishment of many farmers at present on submarginal lands.
11. That a reservoir on the St. Mary River in Canada is the most important feature in the development and that the site discussed in this report is best for the purpose of storing Canada's share of the St. Mary River and tributaries and waters from the Belly and Waterton Rivers.

12. That while irrigation in southern Alberta has encountered many difficulties, owing chiefly to the practice of assessing all costs of construction against the lands irrigated, its value is demonstrated clearly by projects now operating.
13. That with irrigation, soil and climatic conditions in southern Alberta are highly favourable for the production of live stock and for growing forage crops, sugar beets, corn, and a wide variety of specialty crops.
14. That the stabilized agriculture and increased production resulting from further irrigation development in southern Alberta would provide for permanent home building, for a higher standard of living, and for improved social advantages and educational facilities.
15. That the total estimated outlay required to fully and economically utilize Canada's share of the St. Mary and Milk Rivers for the irrigation of 345,000 acres of land on the basis of pre-war prices is estimated at \$15,178,439 or \$43.99 per acre, including construction, operation deficits, land preparation, and colonization costs over a 14-year period of development.
16. That the capital cost is reasonable and that the extensive national and provincial benefits to be expected from the undertaking through business development and reduction of relief costs justify governmental financial assistance.
17. That while the program proposed provides for a 14-year period of construction, the development lends itself to great flexibility both in time and the order in which different parts may be undertaken.
18. That benefits to be derived from the proposed development spread widely throughout the country and accrue:—
 - (a) to the farmer,
 - (b) to the local urban community centres, the municipalities and the province, and
 - (c) to the country at large in increased taxable wealth, increased food supply, and business expansion.
19. That from representations made to the Committee by individual farmers and by various organizations including the South Alberta Water Conservation Council, a representative organization, it is apparent there is a wide demand for the construction of the proposed development.
20. That the representatives of the Alberta Government, while not committing their Government, expressed a strong desire to see the development proceeded with, provided that satisfactory contractual arrangements may be concluded between the Dominion and Provincial Governments.

RECOMMENDATIONS

SUGGESTED DISTRIBUTION OF COSTS

It has become a generally accepted principle that the total costs of an irrigation project of this magnitude should not be charged to the lands immediately benefited. To ensure completion and successful operation of the project, there must be governmental assistance. The development of the St. Mary and Milk Rivers Project would not only be of benefit locally and provincially but would, we believe, be to the general advantage of Canada.

A fair and equitable division of the costs of such a project could be made if it were possible to measure in terms of dollars or as a percentage, the benefits which would accrue to the farmer, the municipality, the province, the transportation and other commercial interests, and to the Dominion generally. Such a division of ultimate benefits is, we believe, not practicable nor possible because of the many unknown and unpredictable factors, for example, future crop yields, prices, availability of domestic and foreign markets, and conditions generally that will prevail after the war.

The municipalities and irrigation districts are creatures of the province, therefore all agreements dealing with land administration, including capital repayments by farmers and the amounts to be paid by them for water rights, do not involve Dominion jurisdiction except in so far as such agreements result in joint colonization plans between the Province and the Dominion.

The construction of the main reservoirs and connecting canals would provide the necessary facilities to store in Canada, Canada's share of these international waters and would thereby be an insurance against the loss of a valuable resource. The construction of the main reservoirs and connecting canals is, however, not enough and unless provision is made, by extension of irrigation works to provide for beneficial and productive use, the expenditure incurred by the Dominion would not be justified.

For this reason the Committee considers that before any construction is undertaken there should be an agreement between the Province and the Dominion that the Province will undertake to construct the remaining irrigation works required to put the water to beneficial use and assume responsibility for maintenance and operation of all works. This agreement, we believe, should be conclusive and should set out, without any ground for doubt or misinterpretation, a distinct division as between Provincial and Dominion responsibility. It should be ratified by legislative action.

The Committee therefore suggests as a first step, that such an agreement be entered into between the Dominion and the Province. This agreement should provide for a co-operative development of the proposed project as broadly outlined in the foregoing paragraph. The Committee further suggests that a reasonable basis for division of costs may be as follows:—

- (a) That the Dominion undertake and assume as a 100 per cent responsibility the construction of the main reservoirs and connecting canals to provide storage facilities for Canada's share of the waters of the St. Mary and Milk Rivers as apportioned under the Order of the International Joint Commission of October 4, 1921.
- (b) That the Dominion's part in the construction of the project be carried out as a Federal post-war development, and that the cost thereof be regarded as non-recoverable.

- (c) That the Province of Alberta construct and carry out as a 100 per cent provincial responsibility the remainder of the proposed construction program as outlined in Part II of this Report, or such modification of this program as may be found necessary and is agreed to by the Provincial and Dominion Governments.
- (d) That the Province of Alberta be wholly responsible for maintenance, operation, and replacements, after construction, of main reservoirs and connecting canals.
- (e) That the Province of Alberta have full jurisdiction with respect to arrangements it may make with its municipalities, irrigation districts or others, as regards repayment of capital or for service charges necessary to the maintenance, operation, and replacement of works.
- (f) That the suggested agreement should provide, among other things, for the settlement and colonization of the irrigated lands.

Based on the foregoing, the following tabulation gives a division of the estimated costs for the total development extending over a period of 14 years:—

ACCOUNT	Dominion's Share	Province's Share	Total Estimated Cost
CAPITAL ACCOUNT	\$	\$	\$
Main Reservoirs.....	4,914,440		4,914,440
Connecting Canals (Main Reservoirs).....	2,278,009		2,278,009
Supplementary Reservoirs with feeder canals.....		1,356,112	1,356,112
Main Irrigation Canals.....		1,642,583	1,642,583
Distribution Systems.....		2,195,520	2,195,520
Power Plants.....		327,470	327,470
Total Construction Cost.....	7,192,449	5,521,685	12,714,134
Land Preparation (\$3 per acre).....		1,035,000	1,035,000
Total Capital Cost.....	7,192,449	6,556,685	13,749,134
REVENUE ACCOUNT			
Estimated Operation and maintenance deficit during development period.....		877,301	877,301
Colonization (\$1 per acre).....		345,000	345,000
Agricultural Services (60c. per acre).....		207,000	207,000
Total.....	7,192,449	7,985,986	15,178,435
Cost per acre.....	20.85	23.14	43.99

The total estimated cost of \$15,178,435 is based on pre-war conditions as mentioned elsewhere in this report. These estimates should be reviewed as related to the unit costs prevailing when construction may be undertaken.

The proportion of costs to be repaid by the farmer is as previously indicated a provincial matter, and no further comment by the Committee would seem necessary, except to point out that the Province may recover a considerable portion of its share of the costs. Without attempting to apportion the amount to be repaid by the farmer, a percentage division is as follows:—

	\$	Per cent
Dominion share (non-reimbursable).....	7,192,449	47.4
Provincial share (subject to such reimbursements as the province may collect from the farmer)	7,985,986	52.6

Based on the above suggested distribution of costs the Dominion's outlay on the project by years would be:—

Period		Reservoirs	Canals	Total
		\$	\$	\$
1st Construction Year.....		750,000		750,000
2nd " "		1,846,151	403,849	2,250,000
3rd " "		848,849		848,849
4th " "				
5th " "				
6th " "			783,924	783,924
7th " "			383,100	383,100
8th " "		492,865	464,642	957,507
9th " "				
10th " "		309,284	242,494	551,778
11th " "		410,906		410,906
12th " "				
13th " "		256,385		256,385
14th " "				
Total.....		4,914,440	2,278,009	7,192,449

GENERAL RECOMMENDATIONS

The Committee is not unmindful of the tremendous burden placed upon the Federal treasury because of the War. We realize the necessity of minimizing expenditures which are not essential to the war effort. We realize that the commencement of construction at this time would involve the employment of labour, skilled and unskilled, and the use of materials essential to war industry. We believe, however, that the St. Mary and Milk Rivers Development should be included as a part of the Dominion's post-war rehabilitation program and we recommend:—

- (1) That the proposed development be reserved as a post-war measure.
- (2) That the Dominion and the Province of Alberta enter into an agreement, to be confirmed by legislation, setting out the general principles governing the development as a co-operative undertaking.
- (3) That surveys and investigations be continued so that construction may be begun without delay after the war.
- (4) That this report be referred to the Committee on Reconstruction.

PART I

INTRODUCTION

By authority of Order in Council P.C. 682 a Committee was established to be known as the St. Mary and Milk Rivers Water Development Committee.

The Committee consisted of:—

Victor Meek, (Chairman) Controller, Dominion Water and Power Bureau, Ottawa, designated by the Minister of Mines and Resources;
George Spence, Director, Prairie Farm Rehabilitation Branch, Regina, designated by the Minister of Agriculture;
William E. Hunter, Accounts Branch, Department of Finance, Ottawa, designated by the Minister of Finance.

The Order in Council provided that the Government of Alberta be invited to appoint or designate one or more persons to work with the Committee, but of which they would not be members. For this purpose the Alberta Government appointed by Order in Council No. 319/41 the following representatives to be known as the Alberta Water Development Committee:—

Honourable D. B. MacMillan, (Chairman) Minister in Charge of Water Resources and Irrigation, Edmonton;
Honourable N. E. Tanner, Minister of Lands and Mines, Edmonton;
P. M. Sauder, (Secretary) Director of Water Resources, Edmonton.

The Order in Council required that the Dominion Committee should not hold public meetings, but with that limitation the Committee was free to invite and receive representations, verbally or in writing or both, from interested bodies and individuals. The Committee was free to invite the co-operation of Departments of the Canadian Government not represented thereon. In particular the Committee was required to invite the co-operation of the Department of External Affairs in dealing with international aspects of the proposals.

MEETINGS

The Committee held preliminary meetings in Ottawa on March 12, 17, and 19, 1941, and engineering features of the proposed development were reviewed April 29 in Calgary. Evidence with regard to the agricultural and community value of irrigation was submitted by various individuals during a two-day meeting held May 1 and 2 at the Dominion Experimental Station, Lethbridge. The evidence and information obtained by the Committee was reviewed December 8, 9, and 10 in Calgary. The final meetings of the Committee were held in Ottawa during the period February 9 to February 20, 1942. Appendix B gives a list of persons who attended one or more meetings held by the Committee.

PROJECTS VISITED

The following projects located nearest the proposed St. Mary and Milk Rivers Development, formerly known as the Lethbridge Southeast Project, were visited by the Committee and others during a motor trip starting from Calgary, September 17, 1941, and finishing at Lethbridge on September 21:—

Eastern Irrigation District, in the vicinity of Duchess, Brooks, Rolling Hills, and Scandia.
Canada Land and Irrigation Project at Vauxhall.
Taber Irrigation District, including Taber and Barnwell.

Alberta Railway and Irrigation Project, including Coaldale and Lethbridge Districts.

Lethbridge Northern Irrigation District.

Raymond Irrigation District.

The proposed site of the St. Mary River Dam was visited during the trip when the party was joined by Dr. T. H. Hogg, Chairman of The Hydro-Electric Power Commission of Ontario, and Mr. G. A. Gaherty, Chairman of the Western Water Problems Committee of the Engineering Institute of Canada. A report on the geological features of the St. Mary Dam site was prepared and submitted by Dr. John A. Allen of the University of Alberta.

ACKNOWLEDGMENTS

The Committee wishes to extend its thanks to the following gentlemen who contributed their time and advice in connection with the investigation:—

- Dr. John A. Allen, Professor of Geology, University of Alberta, Edmonton, Alberta;
- L. C. Charlesworth, General Manager, Eastern Irrigation District, Brooks, Alberta;
- Dr. W. H. Fairfield, Superintendent, Experimental Station, Lethbridge, Alberta;
- G. A. Gaherty, President, Montreal Engineering Company, Montreal, Quebec, and Chairman of The Engineering Institute of Canada Committee on Western Water Problems;
- A. Griffin, Assistant Manager and Chief Engineer, Department of Natural Resources, Canadian Pacific Railway Company, Calgary, Alberta;
- D. W. Hays, General Manager, Canada Land and Irrigation Company, Medicine Hat, Alberta;
- G. N. Houston, Consulting Engineer, Olds, Alberta;
- Dr. T. H. Hogg, Chairman and Chief Engineer, The Hydro-Electric Power Commission of Ontario, Toronto, Ontario;
- S. G. Porter, General Manager, Department of Natural Resources, Canadian Pacific Railway Company, Calgary, Alberta;
- Andrew Stewart, Professor, Department of Political Economy, University of Alberta, Edmonton, Alberta;
- Dr. F. A. Wyatt, Professor of Soils, University of Alberta, Edmonton, Alberta.

The Committee also wishes to extend its thanks to a large number of persons and organizations, including Municipal, Provincial, and Dominion services, for many courtesies and for the kindly help and advice which so ably assisted the Committee in obtaining a comprehensive knowledge of the physical features of the project and its potentialities.

The Committee is also indebted to the Prairie Farm Rehabilitation Act Organization of the Dominion Department of Agriculture for additional field surveys made during the year 1941, for the preparation of preliminary plans and estimates of cost for the proposed development, and particularly to Mr. W. L. Jacobson, Assistant Superintendent of the Water Development Branch of that organization who acted as Secretary to the Committee and compiled its report.

REFERENCES

In its consideration of the proposed St. Mary and Milk Rivers Development, the Committee has reviewed earlier reports and submissions relating to the problem, particularly the following:—

1. Printed Reports of the International Joint Commission Hearings during the years 1915 to 1921 in regard to the Apportionment of the St. Mary and Milk Rivers between Canada and the United States under Article VI of the Boundary Waters Treaty.
2. Annual Reports of the Dominion Reclamation Service for the years 1912 to 1921.
3. Report dated March 1937 of the Ewing Commission appointed by the Government of Alberta to inquire into various phases of Irrigation Development.
4. Submission dated January 26, 1940, by the South Alberta Water Conservation Council to the Dominion Government urging early construction of the further storage and irrigation works necessary to use fully Canada's share of international waters.
5. Report dated January 15, 1941, of the Committee on Western Water Problems under the Chairmanship of Mr. G. A. Gaherty, to the Engineering Institute of Canada as published in the Engineering Journal of May, 1941.

COMPOSITION OF REPORT

Under the terms of reference as outlined above, the Committee was directed to make a comprehensive report of all aspects of the proposals that further storage and irrigation works be built in Canada on the St. Mary and Milk Rivers. Because of the broad scope of inquiry and investigation which the Committee found necessary to establish final conclusions and because of the multiplicity of matters affecting irrigation in general, it has been considered advisable to divide this report into two parts. Part I is a summarization of the factual data gathered by the Committee. Part II comprises full details, followed by tables and appendices, upon which the findings and recommendations are based, and is submitted under eleven main headings with appropriate sub-headings as listed in the table of contents. For ready reference the findings and recommendations of the Committee are presented in the introduction to the report.

SYNOPSIS

INTERNATIONAL FEATURES

The international streams in southern Alberta which provide the water supply for the proposed St. Mary and Milk Rivers Development are the St. Mary, Milk, Belly, and Waterton Rivers, the drainage basins of which are shown on the accompanying plan, Appendix F. The St. Mary and Milk Rivers are capable of being used for irrigation purposes in both Canada and the United States and the Belly and Waterton Rivers although rising in the United States can only be used for irrigation in Canada.

ST. MARY RIVER

This river rises on the eastern slope of the Rocky Mountains in Montana and flows north into Alberta to join the Oldman River near Lethbridge. Its source is in fields of perpetual snow and ice where there is relatively high

precipitation resulting in a fairly steady flow throughout the year. It is one of the most valuable sources of water supply for irrigation in Canada. The average annual run-off at the International Boundary is 661,300 acre-feet.

MILK RIVER

The Milk River rises in the rolling foothills of the Rocky Mountains in Montana, its two main branches crossing the International Boundary and uniting in Alberta. Following a winding course for 210 miles it re-crosses into Montana at Eastern Crossing and flows into the Missouri River. Because of its large drainage basin with its diversified rainfall the flow of the river is subject to wide variations. The average annual run-off at Eastern Crossing is 116,000 acre-feet.

BELLY AND WATERTON RIVERS

These rivers have their source in the Rocky Mountains within Glacier National Park in Montana and, after crossing the International Boundary, flow north within Alberta to join the Oldman River east of Macleod. Because of the mountainous terrain adjacent to these rivers in Montana, their waters cannot be economically utilized for irrigation in the United States but conditions in Alberta permit their utilization there. The average annual flow available at the points of proposed diversion are Belly River, 233,000 acre-feet; Waterton River, 450,600 acre-feet.

BOUNDARY WATERS TREATY

The St. Mary and Milk Rivers provide water for irrigation projects in both countries. In Canada the St. Mary and Milk Rivers can be used to irrigate large tracts of dry lands south and east of Lethbridge. The construction of works to divert water from the St. Mary River to irrigate part of these lands was commenced in 1901. In the United States the St. Mary and Milk Rivers can be merged and used to irrigate lands in the lower Milk River Valley in Montana. The St. Mary and Milk Rivers Project in Montana was authorized in 1903 and was one of the first projects selected for construction under the Reclamation Act passed by the United States Congress in 1902. One of the reasons given for its early selection was to safeguard international water rights asserted by Canada.

Protests from citizens of both countries over the diversion of these waters led to the inclusion of Article VI in the Boundary Waters Treaty of 1909. This treaty provided for the creation of an International Joint Commission to deal with boundary waters generally and Article VI provided for the apportionment of the St. Mary and Milk Rivers between the two countries under the direction of the Commission.

ORDER OF INTERNATIONAL JOINT COMMISSION DATED OCTOBER 4, 1921

When an attempt was made to apportion the St. Mary and Milk Rivers, controversy arose over the interpretation of Article VI particularly with respect to the specific waters to be divided and the manner of dealing with the priorities. The matter was referred to the International Joint Commission and after hearings extending over a period of years, unanimous agreement was reached and is set out in the Commission's Order of October 4, 1921, providing definite rules for the division of water and the application of priorities. This Order has been accepted by Canada as a final settlement of a contentious international problem.

In connection with its Order of 1921, the Commission recommended the construction of reservoirs for joint operation by the two Governments for the purpose of conserving and making the most beneficial use of the waters apportioned. Later investigations have resulted in the location of suitable sites for independent operation.

The recommendations of the Committee are based on the assumption that the method of apportionment of the waters of the St. Mary and Milk Rivers has been finally settled by the Order of the Commission, October 4, 1921, and that Canada may proceed to construct work to utilize fully its share of these waters.

WATER SUPPLY AVAILABLE AND APPORTIONMENT OF ST. MARY AND MILK RIVERS

The average annual flow of the St. Mary and Milk Rivers for the period 1922 to 1940 and the proportionate shares to which each country is entitled at the respective points of measurement, is in round figures as follows:—

Natural flow of Milk River.....		116,000 ac. ft.
United States' share	75,400 ac. ft.	
Canada's share	40,600 " "	
Normal flow of St. Mary River.....		611,300 ac. ft.
United States' share.....	248,700 ac. ft.	
Canada's share	362,600 " "	
Totals		727,300 ac. ft.
The combined share of both rivers is:—		
United States' share	324,100 ac. ft.	
Canada's share	403,200 " "	
		727,300 ac. ft.

The disparity in the relative total shares of the two rivers is due to Canada's priority on the St. Mary River amounting to a greater quantity of water than the United States' priority on the Milk River. Also the larger total share allotted to Canada serves in a measure to balance the use of over 200 miles of Milk River channel in Canada to carry the United States' share of the St. Mary River.

IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN UNITED STATES

The St. Mary and Milk River project in the United States was authorized in 1903 under the Reclamation Act. Construction began in 1906 and was practically completed in 1920. The main irrigation works consist of the Sherburne Reservoir with a capacity of 66,000 acre-feet and a diversion canal from the St. Mary River to the headwaters of the Milk River, known as the St. Mary Storage Unit. The purpose of this diversion is to augment the flow of the Milk River by the addition of the United States' share of the St. Mary River. On the Milk River the main works are the Fresno Reservoir, capacity 126,000 acre-feet; Nelson Reservoir, capacity 66,800 acre-feet, and the necessary diversion dams and distribution canals to serve an irrigable area of 124,000 acres.

The irrigable lands are located in a narrow strip extending for 150 miles along the Milk River Valley. The crops grown are mainly alfalfa and other forage crops, grain, vegetables and sugar beets. In 1940 the crop value reported on the cultivated area amounted to \$28 per acre. The total construction cost reported as repayable by the landowner is about \$60 per acre, but as the amount has not been definitely fixed no repayments have been made.

In 1940 the Saco Divide Unit was approved for construction as one of the water conservation and utilization projects of the rehabilitation program in the drought area of the United States. This project is an extension of the Milk River Project designed to serve an additional 9,400 acres of irrigable land by

pumping. The estimated capital cost to be provided in the first instance from Federal allotments and charged to this extension amounts to \$145 per acre. Of this cost it is proposed that \$93 per acre is to be repaid by the landowner over a period of 60 years without interest.

IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN CANADA

The use of the Milk River in Canada is limited to small individual projects and does not exceed 2,000 acre-feet annually, and only part of Canada's share of the St. Mary River can be utilized with existing works. During the period 1922 to 1940 Canada diverted an average of 163,200 acre-feet annually from the St. Mary River or 45 per cent of its allotted share. The proportion of Canada's share of the St. Mary River that is now being wasted owing to lack of storage and other facilities averages approximately 200,000 acre-feet annually or enough water to irrigate an additional 94,000 acres of land and to also provide for shortages on existing projects served from the St. Mary River.

All water from the St. Mary River that is used for irrigation in Canada is diverted through the works of the Alberta Railway and Irrigation Company, commonly called the A.R. and I., and now owned and controlled by the Canadian Pacific Railway Company. The areas irrigated include the lands served by the original A.R. and I. works and extensions in the Irrigation Districts of Taber, Magrath, and Raymond. The Magrath and Raymond Districts include portions of the original project. The total area irrigable from existing works of the A.R. and I. and Districts is 127,600 acres. To date, however, the area irrigated has not exceeded 120,000 acres.

Canada has, at present, facilities to divert only about 5 per cent of its share of the Milk River and the use of the St. Mary River in Canada with the works so far developed is limited to Canada's share of the low and normal flow. The high and flood waters of the St. Mary River are lost to Canada owing to lack of storage.

While Canada is leaving unused 55 per cent of its share of the St. Mary River and practically all of its share of the Milk River, water users on existing projects served from the St. Mary River are suffering heavy losses through water shortage during the months of July, August, and September, when the river flow is normally below requirements. In years of low precipitation the deficiency has amounted to 60 per cent of requirements during these months.

TOTAL WATER AVAILABLE TO CANADA FROM ST. MARY, MILK, BELLY AND WATERTON RIVERS

The total water for the proposed development is composed of Canada's available share of the St. Mary and Milk Rivers, the inflow of tributary streams to the St. Mary River north of the boundary and a proposed diversion of the Belly and Waterton Rivers into the proposed St. Mary Reservoir. The average annual flow of the Belly and Waterton Rivers is estimated at 675,200 acre-feet.

Three irrigation projects are being supplied by the Belly River and water is reserved for a proposed fourth project. No water is at present diverted from the Waterton River. Allowing for the present and proposed use of water from these streams the capacity of the proposed diversion works would permit an estimated 380,000 acre-feet of water to be diverted from the Belly and Waterton Rivers into the St. Mary Reservoir.

The total water available for use with the facilities proposed in the ultimate development of the project is estimated as follows:—

Water Supply	Total	Available from Proposed Works
	Acre-Feet	Acre-Feet
St. Mary River (Canada's share).....	362,600	362,600
St. Mary tributaries in Canada.....		23,800
Milk River (Canada's share).....	40,600	29,000
Belly River.....	219,500	97,500
Waterton River.....	455,700	282,800
Total.....		795,700

Based on an allowance of 33 per cent for evaporation and seepage losses, an irrigation factor of 80 per cent and an average annual use of 1.40 acre-feet, this quantity of water would supply 465,000 acres of land as the maximum limit of the proposed project. The legal duty of water is 1.50 acre-feet, but since the amount used on existing projects over a long period averages 1.35 acre-feet per acre where full supply is maintained, it is considered that 1.40 acre-feet will be sufficient.

EXISTING IRRIGATION DEVELOPMENT IN ALBERTA

A historical review of existing projects in Alberta is outlined in Section 5 of Part II of this Report.

Some 508,800 acres of land are actually served by existing irrigation works in the twelve district projects in southern Alberta and at the end of 1939 there were 4,379 irrigation farmers operating in this area. In all of the projects at that time there were only 56 farms available for sale and few, if any, were vacant; indicating that existing projects must be extended or new projects must be developed if the number of farmers on irrigated land in the Province is to be increased. Following is a list of district and company projects in Alberta showing source of water supply and the areas actually served from existing works:—

Project	Source of Water Supply	Area Served from Existing Works
		(Acres)
Canada Land and Irrigation Company.....	Bow River.....	40,000
New West Irrigation District.....	Bow River.....	4,500
C.P.R. Western Section.....	Bow River.....	54,000
A.R. and I. Lethbridge.....	St. Mary River.....	84,000
Magrath Irrigation District.....	St. Mary River.....	7,000
Raymond Irrigation District.....	St. Mary River.....	15,100
Taber Irrigation District.....	St. Mary River.....	21,500
Eastern Irrigation District.....	Bow River.....	150,000
Little Bow Irrigation District.....	Highwood River.....	200
Lethbridge Northern Irrigation District.....	Oldman River.....	95,000
United Irrigation District.....	Belly River.....	34,000
Mountain View Irrigation District.....	Belly River.....	3,500
	Total.....	508,800

ECONOMIC VALUE AND BENEFITS OF PROPOSED DEVELOPMENT

The primary purpose in providing irrigation is to increase production by eliminating the hazard of drought. The control of moisture through irrigation affords a high degree of stability in production which gives irrigation an important advantage over dry-land farming. This advantage is fully demonstrated by the greater density of population adequately supported on irrigated as compared to dry land, by the thriving agricultural communities and the prosperous urban centres in the irrigated sections. Irrigation provides for a wide diversity of crops and for the growing and feeding of live stock. It provides opportunity for home building, for maintaining a higher standard of living, and for improved educational facilities and social advantages made possible by a greater density of population.

While the value of irrigation in southern Alberta is demonstrated by many of the projects now operating, irrigation farmers and districts in the past have experienced many difficulties. These have been attributed to various causes but mainly to excessive construction costs assessed against the lands irrigated. The returns realized by the farmers were insufficient to carry the entire capital cost expended for irrigation.

No serious financial difficulties were encountered for instance in the Taber Irrigation District where the capital cost charged to the land amounted to \$16 per acre and the annual rates including capital, maintenance, and operation from 1920 to 1940 varied from \$1.50 to \$2.60 and averaged less than \$2 per acre over a 19-year period. In contrast the Lethbridge Northern Irrigation Project provides an example where capital cost, amounting to \$55 per acre, excluding land, exceeded the amount the farmer could repay.

The economic returns from irrigation and the density of population that may be satisfactorily maintained are determined primarily by the market values of the crops and live stock produced. Information submitted to the Committee and supported by findings of the Economics Division of the Dominion Department of Agriculture shows that the highest returns from irrigation are being obtained from the production of sugar beet and other specialty crops. Soil and climatic conditions in southern Alberta are highly favourable for the growing of sugar beets under irrigation. Expansion of the sugar beet industry in the past has been restricted because of the importation of cane sugar. It may be that future conditions during and following the war will make it desirable and perhaps necessary to enlarge this industry in Canada. Live stock farming, meat production and dairying, appear to offer the greatest immediate opportunity for expansion under irrigation. Expansion in the production of specialty crops may also be expected.

The successful operation of any irrigation project requires that the amount charged to the farmer should be within his capacity to pay and for this reason the construction costs charged to the lands immediately benefited should not exceed the irrigation value of the project to the water users. In 1936 a Commission known as the Ewing Commission was appointed to inquire into the various phases of irrigation development in Alberta. The findings of this Commission are referred to in more detail in Part II of this report. The Committee reviewed the findings of this Commission but did not undertake the extensive inquiry necessary to justify an independent conclusion and, therefore, has not made any attempt to estimate what price the farmer may be expected to pay for land and water in the proposed development.

The Committee suggests, in the event of the project being undertaken, that the lands be classified on the basis recommended by the Ewing Commission and further, that before any settlement takes place, the land values be reviewed and appraised relatively to the revenue-producing capacity of the land. The

Committee would also point out that the collection of irrigation rates and land payments on a crop share basis has been proven advantageous on similar projects.

While the annual cost of maintenance and operation of the proposed development should be regarded as a proper charge against the lands irrigated, a substantial part of the capital cost, depending on conditions, could not be fairly charged against them.

The benefits which the proposed development would confer on Canada, the Province of Alberta, and the residents of the districts affected, may be summarized as follows:—

National Benefits

1. The completion of the development would provide an insurance against the loss of a valuable national resource.
2. The construction of the project following the war would provide employment during the readjustment period.
3. The lands made irrigable would provide opportunity for establishing returned soldiers and others including farm families located on sub-marginal lands within the drought area, thereby effecting a substantial saving in relief expenditures.
4. Increased production and volume of trade from irrigation development would result in business expansion to transportation, manufacturing, and other national interests and the general benefits arising therefrom would be of advantage to Canada as a whole.

Provincial Benefits to Alberta Municipalities and Local Communities

1. Stabilization of agriculture on the lands irrigated and adjoining grazing lands comprising a large section of southern Alberta.
2. Increased production would result in increased assessment values for taxation purposes.
3. Increased production and buying power would result in increased business opportunities to provide goods and services to a prosperous farm population.

Benefits to Ultimate Landowners and Water Users

1. Insurance against crop failure in years of drought.
2. Opportunity for diversifying crops to meet changing market requirements, and to reduce wheat acreage.
3. Increase in land values resulting from increased production.
4. Opportunity for home-building, a higher standard of living, and improved social services.

DESCRIPTION OF AREA OF PROPOSED DEVELOPMENT

The area of the proposed irrigation extension consists of numerous distinct tracts which divide into two main groups including (1) the area extending along the Lethbridge and Medicine Hat Railway and (2) the Milk River area southeast of Lethbridge.

The surface and topographical features vary throughout the different tracts. There are also variations in soil. However, the area of good soil with favourable topography exceeds the area for which water is available. The project has accordingly been planned to develop, as far as possible, the areas of best soil type and most favourable topography.

Wheat is the main crop grown in the area, and in seven municipal units the wheat acreage increased from 182,774 acres in 1925 to 392,266 acres in 1935 according to census reports. This increase has resulted mainly from mechanization and commercialized farming.

The population density in the area of the proposed extension averaged 3.44 persons to the square mile in 1936, including villages and towns.

Relief costs in the area have been moderately low compared to other drought regions of the prairies. A large part of the surplus population emigrated from the area following years of extreme drought and the effects of subsequent drought years were in large measure mitigated by the operation of the irrigation projects to the west, which provided feed, vegetables, and other essentials at reasonable cost. Many dry-land farmers obtained work on irrigated farms. In the municipalities adjacent to existing irrigation projects unpaid agricultural advances and direct relief averaged \$21 per person as compared to \$234.10 per person in areas further from the irrigated areas.

The value of dry land in the area of the proposed development, according to information submitted, varies from \$2.90 to \$6 an acre in the area east of Taber and from \$5.20 to \$15.70 an acre in the area southeast of Lethbridge.

PLAN OF ULTIMATE DEVELOPMENT

The Committee was directed by the Order in Council to make a thorough study of the additional works required to fully utilize the share of the St. Mary and Milk Rivers apportioned to Canada.

The Committee finds that any further use of the waters of St. Mary River is dependent primarily upon the construction of the St. Mary Reservoir. If this reservoir is built of the size necessary to store all of Canada's share of St. Mary River there will be available sufficient water to irrigate 94,000 acres additional to the 120,000 acres now served.

If the cost of constructing the reservoir were entirely assessed against the 94,000 acres of additional irrigated land the charge per acre, \$68.24, would be too great to permit profitable agricultural operation.

If water from the Belly and Waterton Rivers were diverted into the proposed reservoir a total of 326,630 acres additional to the 120,000 acres now served might be irrigated. If the entire cost of the reservoir and distribution works is assessed against this 326,630 acres the charge per acre would be \$37.17.

From this it follows that the building of the reservoir will provide not only for the complete irrigation of 120,000 acres now served and 94,000 acres not now served but, with the addition of further distribution works, for a further 232,630 acres.

If the Milk River Forks Reservoir were constructed approximately 18,000 acres in the Milk River-Warner area could be also irrigated or a total in the entire project of 120,000 acres now irrigated and 345,000 acres not yet irrigated.

As it seems certain that public demand for these extensions would result from the irrigation of the first 94,000 acres, it would seem advisable to consider the inclusion of the entire area in the proposals.

The logical first stage of development would be to extend the existing works to serve 94,000 acres of new land capable of being supplied by the St. Mary River. Thereafter the order of development of the various tracts of land within the proposed St. Mary and Milk Rivers Development may be varied and may be undertaken by stages at such rate as will meet the needs of land settlement or other conditions which may arise.

It is considered that the total expenditures for the construction of works, and preparation of land, the deficits due to operation and maintenance during development, cost of colonization, agricultural advice, etc., estimated to total \$43.99 per acre compares favourably with those of similar projects elsewhere and that they are justified by the benefits expected.

CONSTRUCTION PROGRAM PROPOSED

Storage on the St. Mary River is essential to any further development by irrigation in Canada from that source. The program outlined provides for the construction of the St. Mary River Reservoir and its appurtenant works during the first three years of development to irrigate some 94,000 acres of new land and fully utilize all of Canada's share of the St. Mary River. Following is a brief outline of the construction program proposed:—

- (1) Construction of St. Mary River Reservoir and connecting canal with Chin Coulee Reservoir.
- (2) The enlargement of Chin Coulee Reservoir and outlet canal.
- (3) The orderly development of irrigable areas up to a total of 94,000 acres.

The lands provided for in the first stage are those which can be served from Chin Coulee Reservoir, adjacent to the Canadian Pacific Railway between Taber and Medicine Hat and are as follows:—

		Acres
Third Year	Grassy Lake and Burdette tracts.....	24,600
Fourth “	Yellow Lake and Purple Springs tracts.....	27,000
Fifth “	Big Bend and Medicine Hat tracts.....	42,400

Further development involves the use of the Milk, Belly, and Waterton Rivers and the construction of a number of secondary reservoirs distributed throughout the area. The program proposed provides for a 14-year period of construction. The development, however, lends itself to great flexibility both in time and in the order in which different parts may be undertaken.

Details of the various stages and estimates of yearly expenditures are given in Section 9 of Part II of this report. The total estimated outlay over the 14-year period on the basis of pre-war unit prices is \$15,178,439 including construction, operation deficits, land preparation and colonization costs.

The main canals, secondary reservoirs, and distribution canals would be constructed in conformity with the order of development of the lands selected.

With regard to organization the Committee considers that existing Provincial and Federal Departments, with perhaps some extensions to meet the special requirements, could undertake to carry out the development.

LEGISLATION AND AGREEMENTS

Before the transfer of title to the natural resources of Alberta to the Province in 1931, the granting and administering of surface water rights was a function of the Dominion Government, administrative procedure being defined in its Irrigation Act, since that time by the Province in accordance with the Alberta Water Resources Act. Other relevant Provincial Statutes are the Irrigation Districts Act, 1915 and the Water Users Act, 1920.

Because of the priority of Federal authority in international matters, the Dominion's jurisdiction over the apportionment of the waters of the St. Mary and Milk Rivers as between Canada and the United States is paramount to that of the Province. It is administered by the International Joint Commission.

The Alberta Railway and Irrigation Project owned and controlled by the Canadian Pacific Railway Company supplies water under agreements to the Magrath, Raymond, and Taber Irrigation Districts. The proposed St. Mary and Milk Rivers development is largely an extension of this existing system and as a precedent to the construction of this extension satisfactory arrangements must be made for the inclusion of the Alberta Railway and Irrigation System in the development.

Pages 86 and 87 of this report include a statement of policy of the Alberta Railway and Irrigation Company endorsing the proposed development under certain conditions. This outline of policy provides a basis of negotiation with the company.

COLONIZATION AND RE-ESTABLISHMENT

The St. Mary and Milk Rivers proposed development offers much as a post-war rehabilitation project and for re-establishing farmers from submarginal or inferior lands. The Committee has not undertaken to outline any detailed policy but it is suggested that, in formulating any plan of colonization and rehabilitation, consideration be given to two methods followed by the Prairie Farm Rehabilitation Branch, the permanent removal from cultivation of submarginal lands and the establishment of community pastures.

The Committee would emphasize the necessity of technical advice to inexperienced settlers and of financial and other assistance in preparing the land for irrigation.

PART II

INTERNATIONAL FEATURES

The Order in Council directed the Committee to undertake a thorough study of the water supply available to Canada from its share of the international streams in southern Alberta including the St. Mary, Milk, Belly, and Waterton Rivers and their tributaries. The location and drainage basin of each of these streams is shown on the General Plan, Appendix F. A general description of the drainage basin of each stream follows:—

ST. MARY RIVER DRAINAGE BASIN

The St. Mary River rises in the United States in Glacier National Park, on the eastern slope of the main range of the Rocky Mountains, flows north-easterly into Canada and joins the Oldman River near Lethbridge, Alberta. The principal catchment basin lies in the mountainous area above the outlet of Lower St. Mary Lake, 12 miles south of the International Boundary. Precipitation on this basin averages about 60 inches annually and the average annual run-off is 1,340 acre-feet per square mile. The main water supply originates in the Blackfoot Glacier which is probably the largest glacier on the Rocky Mountains within the United States.

Swiftcurrent Creek, the principal tributary of the St. Mary River in Montana, contributes about 23 per cent of the total flow at the Boundary. The Sherburne Reservoir, located on this tributary, was constructed by the United States Bureau of Reclamation to regulate and make available for diversion during the operation season, the United States' share of the St. Mary River. To divert its share of the St. Mary River to the Milk River for use on irrigated lands in Montana the Bureau of Reclamation constructed a canal between the two rivers. The diversion headworks are situated a short distance below the outlet of Lower St. Mary Lake and Swiftcurrent Creek has been diverted into the St. Mary River immediately above the headworks so that its waters may be available for diversion to the Milk River. Between the headgates and the boundary, the river is joined by two comparatively small tributaries, Kennedy Creek and Boundary Creek.

The river flows into Canada in the southeast quarter of Section 6, Township 1, Range 25, West of the 4th Meridian. The diversion weir and headgates of the Alberta Railway and Irrigation Company's main canal are situated at a point about 6 miles north of the Boundary. This canal delivers water to the irrigation districts in the vicinity of Lethbridge.

Lee Creek, the principal tributary in Canada, has its source near Big Chief Mountain in Montana. After crossing the International Boundary it flows 15 miles through Canada and joins the St. Mary River at Cardston. The average annual run-off of Lee Creek is 39,900 acre-feet. Rolph Creek, Pine-pound Creek, and Pothole Creek are small tributaries from the east which have their source in Milk River ridge and contribute a very limited flow.

The total area of the St. Mary River drainage basin is 1,328 square miles of which 497 square miles are in the United States. The average annual flow of the river at the International Boundary for the period 1922 to 1940 was 611,300 acre-feet.

MILK RIVER DRAINAGE BASIN

Milk River rises in northwestern Montana in the rolling foot-hills of the St. Mary Ridge, the divide between the waters flowing to Hudson Bay and to the Gulf of Mexico. It flows in an easterly direction through southern

Alberta and northern Montana to join the Missouri River near Nashua in eastern Montana. As the drainage basin is beyond the influence of the mountains it does not receive a constant supply from snow and glaciers, consequently the flow of the stream is subject to wide and sudden variations governed largely by precipitation.

From its headwaters, the north branch of Milk River flows northeasterly through Montana, crossing into Canada in Range 23, West of the 4th Meridian. The south branch enters Canada in Range 20 and joins the north branch near the middle of Township 2, Range 18, to form the main stream. In Canada the stream flows on a course generally parallel to the International Boundary, finally entering Montana at Eastern Crossing near the easterly boundary of Range 5.

Throughout its course in Canada, the main stream is joined by several small tributaries which have their source in the Sweetgrass Hills in northern Montana. In Montana, Milk River is fed by numerous tributaries, from both the north and south. The tributaries from the north rise in the Cypress Hills in southwestern Saskatchewan and in the Order of the International Joint Commission of October 4, 1921, are designated the Eastern Tributaries of Milk River. Those from the south are mainly from the Bear Paw Mountains in central Montana.

Only a limited diversion of water for irrigation is made from the upper reaches of the river in Montana or from the main stream in Canada but a large irrigation project under the control of the United States Bureau of Reclamation is situated in the lower Milk River Valley between Chinook, Montana, and the mouth of the river. Here climatic conditions are semi-arid and annual precipitation averages only about 14 inches.

To utilize the waters of Milk River and the water diverted into the Milk River basin from St. Mary River, numerous irrigation facilities have been constructed in the river valley in Montana. The main works are the Fresno Dam forming the Fresno Reservoir, the diversion dams at Dodson and Vandalia and the Nelson Reservoir near Malta.

The Milk River drainage basin above Eastern Crossing covers an area of 2,514 square miles and the average annual run-off is estimated at 116,000 acre-feet for the period 1922-1940 inclusive.

BELLY RIVER DRAINAGE BASIN

The Belly River rises in Glacier National Park in northwestern Montana and flows northerly into Canada. The main stream has its source in Ahern Glacier and Helen Lake and flows almost due north to the centre of Township 2, Range 28, West of the 4th Meridian, Alberta, thence following a northeasterly course to its junction with Oldman River in Township 9, Range 23, West of the 4th Meridian.

Numerous tributaries join the main stream in Montana but there are two principal branches. One is the Middle Fork which rises in Chany and Shepard Glaciers and after passing through Glenn's Lake, joins the river about five miles south of the International Boundary. The other main branch is the North Fork which rises in a small glacier-fed lake and joins the river about three miles south of the International Boundary. In Canada the main tributaries to the river are Mami Creek and Layton Creek from the east and Waterton River from the west.

The Belly River is not referred to in the Boundary Waters Treaty, since the use of the flow of the river in Montana for irrigation is not considered economic owing to the mountainous terrain. In Canada, the Belly River supplies water to several small irrigation projects and to the Mountain View, Leavitt, and United Irrigation Districts. It is proposed to divert the balance of the flow to St. Mary River.

The area of the drainage basin of Belly River, at Stand Off, near its junction with Waterton River, is 477 square miles and the average annual run-off at this point is 274,000 acre-feet. The area of the drainage basin above the proposed point of diversion near Mountain View is 121 square miles with an average annual run-off at that point of 233,000 acre-feet for the period 1912 to 1931 inclusive.

WATERTON RIVER DRAINAGE BASIN

The Waterton River has its source in Waterton Lakes, which lie in Township 1, Ranges 29 and 30, in Canada, and in the Glacier National Park in Montana. These lakes are fed by numerous tributaries rising in the Rocky Mountains in Montana and southern Alberta. The main tributaries of Upper Waterton Lake in Montana are the Little Kootenai, Valentine, Olsen, and Boundary Creeks. The principal tributaries in the Canadian basin are Cameron, Blakiston, Cottonwood, Drywood, and Foothill Creeks from the west and Crooked Creek from the east. From Lower Waterton Lake, the river flows northeasterly to join Belly River in Section 2, Township 7, Range 25, West of the 4th Meridian.

As in the case of the Belly River the United States tributaries of the Waterton River flow through a mountainous terrain which precludes their use for irrigation. It is proposed to divert water in Canada from this stream to the Belly River and re-divert it, with the surplus from the Belly River, to the proposed St. Mary Storage Reservoir to supply the additional water required for the full development of the St. Mary and Milk Rivers Project.

The area of the drainage basin of Waterton River above its mouth near Stand Off is 695 square miles with an average annual run-off of 638,000 acre-feet. The area of the basin above the proposed point of diversion near Waterton Park is 238 square miles with an average annual run-off of 450,600 acre-feet.

EVENTS LEADING TO BOUNDARY WATERS TREATY

In 1894 at the annual meeting of the International Irrigation Congress in Denver, a resolution sponsored by Canadian delegates was adopted urging the Governments of the United States, Mexico, and Canada to create a joint commission to consider questions arising out of the use, for irrigation, of the waters of international streams. A similar resolution was adopted by the Congress in September, 1895, at Albuquerque, New Mexico.

The Canadian Government on January 8, 1896, indicated to the United States its desire to co-operate in the formation of such a committee but the United States Secretary of State, although expressing his personal interest, stated that he was unable to give expression to the views of his government. In 1901 it was reported that the proposed St. Mary Canal in the United States had been located but construction had not commenced. The Canadian Government in 1894 and subsequent years had had surveys made to ascertain whether or not the diversion of the waters of the St. Mary River for irrigation in Canada was practicable. The Canadian Government by offering to co-operate in the formation of an International Committee was endeavouring, before any responsibilities had been assumed, or vested rights created, to secure consideration of the international features of the situation on the St. Mary River.

The United States Reclamation Act which was passed by Congress in 1902 provided for irrigation construction by the Federal Government. Action was immediately taken by the Reclamation Service to divert water from the St. Mary River to the Milk River to irrigate lands in the lower Milk River Valley. The Canadian Government protested to the United States against the proposed diversion but no definite action was taken by the United States Government until May, 1904, when it forwarded a protest from citizens of Montana against the construction of a canal in Canada, from the Milk River.

Negotiations over these two protests finally resulted in the inclusion of Article VI in the Boundary Waters Treaty between Great Britain and the United States signed on January 11, 1909. Article VI provides for the measurement and apportionment of the waters of the St. Mary and Milk Rivers under the direction of an international joint commission established under the terms of the treaty.

ARTICLE VI OF THE BOUNDARY WATERS TREATY

"The High Contracting Parties agree that the St. Mary and Milk Rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the diversion of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary River, or so much of such amount as constitutes three-fourths of its natural flow.

"The channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary River. The provisions of Article II of this treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk River.

"The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission."

CONTROVERSY OVER INTERPRETATION OF ARTICLE VI

The accredited officers of the two governments responsible for the apportionment under the treaty were unable to agree upon the interpretation of Article VI. With the approval of the International Joint Commission an informal conference was held in Washington in April, 1915, between the reclamation and other officials of Canada and the United States for the purpose of outlining a basis of settlement satisfactory to both countries.

Agreement was reached on some minor points but little was accomplished in reaching agreement on the really important questions. The main points of disagreement were:

1. The waters to be divided by the terms of Article VI.

The Canadian contention was that the waters to be divided included the St. Mary and Milk Rivers and all their tributaries or the total flow of the combined watershed down to the mouths of the rivers.

The United States officials held the opinion that the waters to be divided were those waters only which flow across the International Boundary.

2. Priority to be applied.

The Canadian contention was that in the division of the waters of these streams and their tributaries the priorities amounting to three-quarters of the natural flow up to 500 cubic feet per second should first be set aside and the remainder of the flow then divided equally.

The United States officials contended that the equal division should be inclusive of the priorities mentioned.

The accredited officers of the two governments being unable to agree as to the interpretation of Article VI, the matter was referred to the Commission for decision.

ACTION OF INTERNATIONAL JOINT COMMISSION

Before arriving at its decision, the Commission held a public hearing at St. Paul, Minnesota, on May 24-28, 1915, to hear the claims of all interested parties. Claims were presented by the Governments of Canada and the United States, the State of Montana, and the Provinces of Alberta and Saskatchewan, also by the Great Northern Railway Company, the Canadian Pacific Railway Company, and various water users' associations of both Montana and Saskatchewan.

Within sixty days of this hearing written briefs were submitted to the Commission by the Governments of the United States and of Canada, and by the Canadian Pacific Railway Company.

The Commission held a supplemental hearing in Detroit, Michigan, on May 15, 1917, to permit the United States Government to submit further argument. No new evidence was presented, the purpose of the hearing being to permit further argument of the United States contention that Canada's interpretation of Article VI was contrary to the intent of the framers of the Treaty. All those who had previously appeared were given an opportunity to reply to the arguments. The Commission reserved its decision.

On November 7, 1917, the United States Secretary of State advised the Commission that the view of his Government was that the Boundary Waters Treaty gave the Commission no authority to decide the interpretation of Article VI of that Treaty and for that reason any conclusion reached by the Commission would not be considered binding by the United States. The Secretary of State modified this view in a letter to the Commission on November 11, 1919, by stating that there was no intention of precluding the Commission from exercising its functions as a purely administrative body in determining what waters it should, under Article VI, measure and apportion.

The United States St. Mary Canal was completed and diversion commenced in 1917. The Commission, pending their final decision, issued interim orders during 1918, 1919, 1920, and 1921. The apportionment by these interim orders was based on the estimated requirements of the land to be irrigated. These orders were not intended as the final interpretation of Article VI of the Treaty.

Following the deaths of two Members of the Commission a review of the argument as to the interpretation of Article VI was held in Ottawa, Canada, on May 3, 1920, to acquaint their successors with the representations previously made.

Finally to facilitate the presentation of their views by the settlers using the waters and of other directly interested parties, the Commission held hearings on September 15, and 17, 1921, at Chinook, Montana, and Lethbridge, Alberta, within the irrigation districts affected. Legal representatives were not heard, only the views of directly interested parties being permitted. A considerable number of both United States and Canadian settlers stated their views at these hearings.

FINAL ORDER OF THE INTERNATIONAL JOINT COMMISSION DATED OCTOBER 4, 1921

On October 4, 1921, the International Joint Commission issued an Order respecting the measurement and apportionment of the waters of the St. Mary and Milk Rivers. This order was accepted by the Canadian Government as a final settlement.

This Order, quoted hereunder, was based, in part, on the contentions of both countries. The contention of Canada was upheld to the extent that priorities of flow assigned to either country are to be set aside first and the remaining waters divided equally. The contention of the United States was upheld to the extent that the order provided for the apportionment of those waters which would naturally flow across the International Boundary.

FINAL ORDER OF THE INTERNATIONAL JOINT COMMISSION DATED IN OTTAWA,
OCTOBER 4, 1921

"It is therefore ordered and directed by the Commission in pursuance of the powers conferred by the said Article VI of the said Treaty that the Reclamation and Irrigation Officers of the United States and Canada shall, until this Order is varied, modified, or withdrawn by the Commission, make jointly the measurement and apportionment of the water to be used by the United States and Canada in accordance with the following rules:—

"St. Mary River.

- "I. (a) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is six hundred and sixty-six (666) cubic feet per second or less Canada shall be entitled to three-fourths and the United States to one-fourth of such flow.
- (b) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is more than six hundred and sixty-six (666) cubic feet per second Canada shall be entitled to a prior appropriation of five hundred (500) cubic feet per second, and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.
- (c) During the non-irrigation season the natural flow of the St. Mary River at the point where it crosses the international boundary shall be divided equally between the two countries.

"Milk River.

- "II. (a) During the irrigation season when the natural flow of the Milk River at the point where it crosses the international boundary for the last time (commonly and hereafter called the Eastern Crossing) is six hundred and sixty-six (666) cubic feet per second or less, the United States shall be entitled to three-fourths and Canada to one-fourth of such natural flow.
- (b) During the irrigation season when the natural flow of the Milk River at the Eastern Crossing is more than six hundred and sixty-six (666) cubic feet per second the United States shall be entitled to a prior appropriation of five hundred (500) cubic feet per second and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.
- (c) During the non-irrigation season the natural flow of the Milk River at the Eastern Crossing shall be divided equally between the two countries.

"Eastern Tributaries of Milk River.

- "III. The natural flow of the eastern (otherwise known as the Saskatchewan or northern) tributaries of the Milk River at the points where they cross the international boundary shall be divided equally between the two countries.

“Waters not naturally crossing the Boundary.”

“IV. Each country shall be apportioned such waters of the said rivers and of any tributaries thereof as rise in that country but do not naturally flow across the international boundary.

“V. For the purpose of carrying out the apportionment directed in paragraphs I, II, and III hereof the said Reclamation and Irrigation Officers shall jointly take steps—

- (a) To ascertain and keep a daily record of the natural flow of the St. Mary River at the international boundary, of the Milk River at the Eastern Crossing, and of the eastern tributaries of the Milk River at the international boundary by measurement in each case:
 1. At the gauging station at the international boundary;
 2. At all places where any of the waters which would naturally flow across the international boundary at that particular point are diverted in either country prior to such crossing;
 3. At all places where any of the waters which would naturally flow across the international boundary at that particular point are stored, or the natural flow thereof increased or decreased prior to such crossing.
- (b) To fix the amount of water to which each country is entitled in each case by applying the directions contained in paragraphs 1, 2, and 3 hereof to the total amount of the natural flow so ascertained in each case.
- (c) To communicate the amount so fixed to all parties interested, so that the apportionment of the said waters may be fully carried out by both countries in accordance with the said directions.

“VI. Each country may receive its share of the said waters as so fixed at such point or points as it may desire. A gauging station shall be established and maintained by the Reclamation or Irrigation Officers of the country in which any diversion, storage, increase, or decrease of the natural flow shall be made at every point where such diversion, storage, increase, or decrease takes place.

“VII. International gauging stations shall be maintained at the following points:

St. Mary River near international boundary; the north branch of Milk River near international boundary; the south branch of Milk River near international boundary; Milk River at Eastern Crossing; Lodge Creek, Battle Creek, and Frenchman River, near international boundary; and gauging stations shall be established and maintained at such other points as the Commission may from time to time approve.

“VIII. The said Reclamation and Irrigation Officers are hereby further authorized and directed:

- (a) To make such additional measurements and to take such further and other steps as may be necessary or advisable in order to ensure the apportionment of the said waters in accordance with the directions herein set forth.
- (b) To operate the irrigation works of either country in such a manner as to facilitate the use by the other country of its share of the said waters and subject hereto to secure to the two countries the greatest beneficial use thereof.
- (c) To report to the Commission the measurements made at all international and other gauging stations established pursuant to this order.

"IX. In the event of any disagreement in respect to any matter or thing to be done under this order the said Reclamation and Irrigation Officers shall report to the Commission, setting forth fully the points of difference and the facts relating thereto.

"X. The said order of the Commission, dated the 6th day of April, 1921, is thereby withdrawn, except with respect to the report to be furnished to the Commission thereunder."

APPLICATION OF UNITED STATES TO AMEND ORDER

The Order of the Commission was not completely acceptable to the water users' associations in Montana as indicated by a protest registered with the Commission on March 27, 1922, and also by a request of the United States Secretary of State on July 26, 1927, that the matter be re-opened and a new order issued. The basis of the request was that the Order of 1921 did not effect an equal division of the waters of St. Mary River, and that the United States' contention in respect to the priorities was not upheld. It was also claimed that the United States priority on Milk River should also apply to its Eastern Tributaries which cross the International Boundary.

The Canadian Government having accepted the Commission's Order as a final settlement of the problem, notwithstanding that it did not concede all that Canada had claimed, did not join in their request, contending that any such re-opening should only result from new conditions arising which were unforeseen at the date of the Order.

The Commission heard argument on behalf of the request of the United States, at Washington, D.C., on April 4, 1928, and again on April 10, 1931, and the argument of the Canadian Government against re-opening the case, in Ottawa, Canada, on October 6, 1931. The Commission's Order of 1921 is still operative and governs the apportionment of the waters of the St. Mary and Milk Rivers.

RECOMMENDATIONS OF INTERNATIONAL JOINT COMMISSION REGARDING STORAGE

On October 6, 1921, the Commission made the following recommendations to the Governments of the United States and Canada:

"It is therefore ordered that the following recommendations be respectfully submitted to the Governments of the United States and Canada:

"That the Governments of the United States and Canada enter into an agreement for the construction of a reservoir at St. Mary Lakes in Montana.

"That the Reclamation Service of the United States proceed with the construction of the proposed Chain-of-Lakes Reservoir in Montana, and the Canadian Reclamation Service with the proposed Verdigris Coulee Reservoir in Alberta.

"That all reservoirs herein mentioned be constructed, controlled, and operated in the manner, for the purpose, and subject to the conditions above set forth."

In connection with the foregoing recommendations of the Commission, that the Governments of the United States and Canada enter into an agreement to construct a reservoir at St. Mary Lakes, the Canadian Government by Order in Council, P.C. 1139, dated May 31, 1922, pointed out that since the construction recommended required capital expenditure of Canadian funds on permanent works in the United States, it was considered expedient that the matter should await approval by Parliament.

The matter has not been referred to Parliament as it has since been shown that the construction of a reservoir to store Canada's entire share of the waters of the St. Mary and Milk Rivers may be made at Spring Coulee in Canada, obviating the spending of Canadian funds in the United States.

By constructing its Sherburne Reservoir on Swiftcurrent Creek and enlarging the United States St. Mary Canal to its designed capacity of 850 second-feet, the United States has made available facilities for controlling practically all of its share of the St. Mary River under normal conditions. The United States, by constructing the Fresno Dam in the Milk River Valley below the Boundary, has provided sufficient storage to impound its entire share of the waters of the St. Mary and Milk Rivers and also Canada's share of Milk River which is not being utilized in Canada.

The construction by Canada of a reservoir in Verdigris Coulee, Alberta, as recommended by the Commission is not included in later plans as the proposed construction of the Forks Reservoir, just below the junction of the North and South branches of Milk River, would provide storage for all of Canada's share of the waters of Milk River not now being used in Canada.

From the foregoing it follows that the present status of international water storage is, briefly:—Reservoirs have been constructed within the United States of sufficient capacity to regulate the United States' share of the St. Mary and Milk Rivers. Preliminary surveys have been made of reservoirs in Canada which should enable Canada to use its full share of these waters. The findings of this Committee are based on the assumption that the division of the water supply was finally settled by the International Joint Commission's Order of October 4, 1921, and that Canada may proceed to construct the necessary work to utilize fully its share of these waters.

WATER SUPPLY AVAILABLE AND APPORTIONMENT OF ST. MARY AND MILK RIVERS

The water supply for the irrigable lands, included in the proposed St. Mary and Milk Rivers Development, is that of the St. Mary, Milk, Waterton, and Belly Rivers. Exhaustive studies show that these streams would provide sufficient water for the irrigation of 465,000 acres if the development of the main and secondary storage sites available were completed. The withdrawal of the necessary water to irrigate this 465,000 acres would not affect existing irrigation and riparian rights.

In addition to the 465,000 acres referred to above there is an area of 78,000 acres of irrigable land in the Warner, Pakowki Lake and Etzikom Districts, as shown on the map herewith (Appendix F). A further additional area of 87,000 acres on the Blood Indian Reserve could also be included if water were available.

APPORTIONMENT AND USE OF ST. MARY RIVER

Canada.—The present maximum rate of diversion in Canada is 1,200 cubic feet per second, the capacity of the Alberta Railway and Irrigation Company's diversion canal. The canal can only be operated during the open water season. Without storage, therefore, within the valley of the river, Canada's total share of the winter flow and its share in excess of the capacity of the existing diversion canal cannot be utilized. As a consequence Canada was compelled, during the period 1922 to 1940, to waste annually an average of approximately 200,000 acre-feet of its share of the St. Mary River. Had this water been conserved it would have provided for the irrigation of 94,000 acres.

The quantity of water diverted by Canada from St. Mary River during this period averaged 163,000 acre-feet annually, or 45 per cent of its share. The yearly diversion during this period varied from 21 per cent in 1927, a year of high precipitation, to a maximum of 72 per cent in 1931, a year of very low precipitation.

United States—During the 19-year period following the Commission's Order of October 4, 1921, the United States diverted from St. Mary River to Milk River an average of 122,000 acre-feet annually, or 49 per cent of its share. The yearly diversion varied from 11 per cent in 1927 to 90 per cent in 1939, a year of very low precipitation.

The Sherburne Reservoir with a capacity of 66,000 acre-feet provides storage for the United States' share of the winter flow and the flood water of the St. Mary River. The United States has also completed the Fresno Reservoir of 126,000 acre-feet capacity on the Milk River and the Nelson Reservoir of 66,800 acre-feet capacity in the lower Milk River Valley. These three reservoirs enable the United States to regulate the use of its entire share of St. Mary and Milk Rivers except in years of very high run-off.

Records of the St. Mary River flow are given in Tables I and II of the Appendix, showing (1) total annual flow in acre-feet at the International Boundary for the period 1922 to 1940 inclusive; (2) the share allotted to each country by the Final Order of the Commission; (3) the portion of each share diverted for use; and (4) the portion of each share wasted.

APPORTIONMENT AND USE OF MILK RIVER

The only use made by Canada of its share of the waters of the Milk River is for supplying not more than 2,000 acre-feet annually to a group of small irrigation projects, mainly on tributary creeks. The remainder of Canada's share obviously augments the supply for the Milk River Project in Montana.

Since 1916 the United States Reclamation Service has been diverting water from St. Mary River to Milk River through the St. Mary diversion canal. This water has been used to increase the supply for the irrigable lands on the Milk River Project in Montana. The basis of division of Milk River between the United States and Canada, as provided for in the 1921 Order of the International Joint Commission, is the natural flow of the river at Eastern Crossing. For the purpose, therefore, of computing the respective share of either country, the natural flow at this point has been determined. This has been computed for the period 1922 to 1940 inclusive by deducting from the flow as measured at the boundary the amount diverted from the St. Mary River which would reach this point after allowing for losses in transit. On this basis the average annual natural flow at the Eastern Crossing of Milk River was computed as 116,000 acre-feet. Canada was entitled by the Order to 40,600 acre-feet of this quantity and the United States to 75,400 acre-feet.

Table III of the Appendix shows (Column 2) the total annual flow in acre-feet of Milk River at Eastern Crossing for the period 1922 to 1940; (Column 3) the share of Milk River to which each country is entitled under the Commission's Order; and (Columns 6 and 7) the total share of each country of the total flow of the St. Mary and Milk Rivers.

Table IV in the Appendix shows (Column 2) the total United States share of the St. Mary and Milk Rivers; (Column 3) the quantity diverted from Milk River in Montana; and (Column 5) the percentage of the United States share which was diverted. The United States also has available for diversion from Milk River, water from tributaries south of the International Boundary which is not included in the United States share of the St. Mary and Milk Rivers. The table shows that the United States diverted an average of 54 per cent of its share of the combined flow of the St. Mary and Milk Rivers at the Boundary.

COMBINED FLOW OF ST. MARY AND MILK RIVERS

The average annual flow of the St. Mary and Milk Rivers and the respective shares therein of Canada and the United States may be summarized as follows:—

Natural flow of St. Mary River.....		611,300 ac. ft.
United States' share	248,700 ac. ft.	
Canada's share	362,600 " "	
Natural flow of Milk River.....		116,000 ac. ft.
United States' share	75,400 ac. ft.	
Canada's share	40,600 " "	
Total		727,300 ac. ft.
The combined shares of both rivers is:—		
United States' share	324,100 ac. ft.	
Canada's share	403,200 " "	
		727,300 ac. ft.

During the period 1922 to 1940 the United States used 54·0 per cent of its share of the combined flow of the St. Mary and Milk Rivers, while Canada used 40·5 per cent of its share.

Canada's share of the combined flow of the two rivers averages 403,200 acre-feet or 55 per cent of the total of 727,300 acre-feet measured at the Boundary. The United States' share averaged 324,100 acre-feet or 45 per cent of the total combined flow. The difference in shares is accounted for by Canada's priority on St. Mary River amounting to a greater quantity of water than the United States' priority on Milk River. Also the larger share allotted to Canada serves to compensate for the use by the United States of over 200 miles of the Milk River channel in Canada to carry its share of St. Mary River.

IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN UNITED STATES

The United States has undertaken extensive and costly developments to fully utilize its share of the St. Mary and Milk Rivers apportioned to it in the 1921 Order of the International Joint Commission. These developments include the St. Mary Diversion Canal; the Sherburne Reservoir; the Chinook, Malta, and Glasgow Divisions of the Milk River Irrigation Project; and the Fresno and Nelson Reservoirs. In addition, an extension is proposed to include the Saco Divide unit. These works now provide storage for 258,800 acre-feet of water for the irrigation of 124,000 acres of land in Montana.

HISTORY AND EXTENT OF MILK RIVER PROJECT IN UNITED STATES

Federal aid in irrigation development was initiated in the United States by the Reclamation Act of June 17, 1902. This legislation provides that moneys derived from the sale of public lands and from certain other sources within the states to be benefited are to be placed in a Reclamation Fund and used for the construction of irrigation works to reclaim arid and semi-arid lands. The settlers on the reclaimed lands are required to repay, in annual instalments without interest, over periods up to 40 years, the construction costs of the projects and these repayments are used to reclaim additional lands.

The St. Mary and Milk Rivers Project was authorized in 1903 in accordance with the terms of the Reclamation Act. It was one of the first projects selected for construction under this legislation and one of the reasons given for its early selection was to safeguard international water rights asserted by Canada.

The irrigable lands within the project are located in a narrow strip in the Milk River Valley in Montana extending from Lohman to Nashua, a distance of approximately 150 miles. The water supply is derived from Milk River

and its tributaries and from diversion of water into Milk River from the headwaters of St. Mary River. Construction began in 1906 under a progressive program of development and water was first available to project lands in 1911.

The construction of most of the irrigation works was completed by 1920. Development to date consists of the following main divisions as shown on accompanying plan, Appendix F.

ST. MARY STORAGE DIVISION

This Division includes the Sherburne Reservoir of 66,000 acre-feet capacity on Swiftcurrent Creek and a diversion canal of 850 cubic-feet per second capacity from the St. Mary River to the North Fork of the Milk River to divert the United States' share of the waters of the St. Mary River. This canal and reservoir provide for the complete utilization of the United States share of the waters of the St. Mary River except in years of abnormally high flows.

CHINOOK DIVISION

This Division includes the districts extending along the Milk River Valley from Lohman to Dodson containing a total irrigable area of 42,809 acres. These districts divert water from Milk River into privately-owned canals and pay a per-acre charge to the United States Bureau of Reclamation for the delivery of the necessary water supply from St. Mary and Milk Rivers.

MALTA DIVISION

This Division includes 57,060 acres of irrigable land between Dodson and Hinsdale and is controlled and operated by the United States Bureau of Reclamation. The works consist of the Dodson Dam on Milk River which diverts water into the North Canal, with a capacity of 200 cubic-feet per second and also into the South Canal with a capacity of 900 cubic-feet per second. The South Canal also carries water to Nelson Reservoir, which has a capacity of 66,800 acre-feet and serves lands in the vicinity of Saco and Beaverton and at the same time delivers stored water to the river for use on the Glasgow Division.

GLASGOW DIVISION

This Division includes 22,000 acres of irrigable land on the south side of the river between Vandalia and Nashua, and is controlled and operated by the United States Bureau of Reclamation. The works consist of the Vandalia Dam and the main canal, with a capacity of 300 cubic-feet per second.

FRESNO RESERVOIR

Shortly after 1935 the Bureau of Reclamation commenced and has since completed construction of the Fresno Dam located on Milk River about 28 miles south of the International Boundary. The purpose of this dam is to improve the water supply for the Milk River Project by creating storage to control the flow of Milk River. This reservoir has a capacity of 126,000 acre-feet. The cost, amounting to approximately \$1,700,000, was provided as a part of the Federal program of public works undertaken with allotments of emergency funds. Provision has been made for repayment without interest over a term of years by the owners of the lands benefited within the Milk River Project.

IRRIGATION DEVELOPMENT

The Bureau of Reclamation reported, in 1940, that the total irrigable area within the Milk River Project for which the Bureau was prepared to

supply water was approximately 124,000 acres. The crops produced include grain, vegetables, sugar beets, alfalfa and other forage crops. The crop value for the year 1940 on the 43,000 acres in cultivation averaged \$28 per acre. The number of irrigated farms on the project was 691 with a rural population of 2,684.

FINANCES

The total construction cost of the Milk River Project provided from the Reclamation Fund as reported at the end of the fiscal year 1940 was \$6,926,011. The amount to be repaid under the provisions of the Reclamation Act has not been finally determined. The original irrigable area within the project was variously estimated at from 150,000 to 250,000 acres. On development it was found uneconomical to irrigate much of this land, consequently the proportionate share of the construction cost applicable thereto was written off. From the 1940 report of the United States Bureau of Reclamation the total amounts repayable by the landowners are approximately as follows:—

Milk River Project	\$5,653,000
Fresno Reservoir	1,675,000
	<hr/>
	\$7,328,000

Taking the total irrigable area in 1940, as reported at 124,000 acres, the amount repayable would be approximately \$60 per acre. The capital cost per acre to be repaid, as already indicated, has not yet been fixed and to date only the annual charges for maintenance and operation have been collected.

PROPOSED EXTENSION OF MILK RIVER PROJECT, SACO DIVIDE UNIT

This proposal contemplates the extension of the Milk River project to provide a water supply for an additional 9,400 acres of good irrigable land in the vicinity of Saco which lies at too high an elevation to be served by gravity. The construction required involves the enlargement of the present Nelson South Canal, installing pumping plants to lift 100 second-feet of water about 85 feet and a lateral system to the lands. The plan is to obtain power for pumping from the power plant now installed at the Fort Peck Dam.

This project was approved for construction by legislation in 1940 as one of the Water Conservation and Utilization Projects to be undertaken co-operatively by the Departments of Interior and Agriculture with the object of rehabilitating drought areas in the Great Plains Region of the United States. The capital cost is provided by the Federal Government from allotments under the Department of the Interior Appropriation Act and allotments from general funds for Work Project Administration and Civilian Conservation Corps. Approximately 46 per cent of the new funds required is to be repaid by the water users.

The new construction for the Saco Divide Unit is estimated to cost \$570,000 or about \$60 per acre of which the landowners will be required to repay \$210,000. The landowners will also be required to repay a proportionate share of the cost of the Fresno Dam estimated at \$245,000 and a proportionate share of the Milk River Project facilities estimated at \$225,000.

The Bureau of Reclamation reports that on the developed parts of the Milk River Project it is believed that an annual charge of \$3.60 per acre for combined construction and operation and maintenance is the extent of the obligation for irrigation costs, exclusive of land development, that can be assumed by the water users. On the Saco Divide Project the estimated cost of pumping and maintenance and operation is \$2.35 per acre per year which would leave \$1.25 per acre as the maximum which might be applied to construction costs.

The plan of repayment provided by the legislation contemplates the repayment first of the amounts allocated to the Saco Divide Project for new construction and its share of the cost of Fresno Dam and Reservoir, totalling \$48 per acre, in not to exceed forty annual instalments without interest. Payment of the instalments is to commence at the end of a development period to be set by the Secretary of the Interior within 10 years after water is first delivered to lands of the project. Following the completion of these payments the cost of the common facilities of the Milk River Project, estimated at \$24 per acre, is to be repaid in a further twenty annual instalments without interest.

A further proposal provides for the expenditure of an additional \$330,000 by the Department of Agriculture on the 9,400 acres in this extension for colonization and land development including levelling and preparing the land for irrigation. Provision is made that \$200,000 of this amount is to be repaid by the landowners under a separate contract in forty annual instalments without interest.

Following is a summary of the total costs chargeable to the Saco Divide Extension showing the distribution and amounts reimbursable:—

—	Estimated Cost	Per Acre	Non- Reim- bursable	Per Acre	Reim- bursable	Per . Acre
	\$	\$	\$	\$	\$	\$
New Construction.....	570,000	60	360,000	38	210,000	22
Land Development.....	330,000	35	130,000	14	200,000	21
Share Milk River Project.....	225,000	24	.....	.....	225,000	24
Share Fresno Dam.....	245,000	26	.....	.....	245,000	26
Totals.....	1,370,000	145	490,000	52	880,000	93

The total reimbursable cost of \$93 per acre is to be repaid by the landowners in annual instalments without interest over a period of 60 years.

ECONOMIC FEASIBILITY

As an indication of the benefit which it is considered the United States would receive in return for the capital expenditure on the construction of the Saco Divide Extension, the following is quoted from Report No. 2142 of the Senate Committee on Irrigation and Reclamation dated September 19, 1940:—

"This was a fine stock country before the dry-land farmers settled it up. For a few years there was considerable rainfall and settlers came in. All the land was taken up. Then it turned dry. The farmers have been unable to make a living. Over 650,000 acres of land in Phillips and Valley counties have been taken by the counties for taxes. Most of the farmers are on relief or some form of Government work. Enormous amounts of money have been expended by the Government in seed loans, feed loan, and relief. It is becoming more apparent every year that the dry-land farmers cannot make a living. Yet there is no place for them to go. Either the Government must continue to pour money in here to keep the dry-land farmers going or some permanent way to permit them to make a living must be provided.

"This irrigation project will solve the problem. It will give them work while it is being constructed. They can get small tracts under this project and this together with their dry land for pasture will give them a truly economic set-up. This territory is provided to raise winter feed. A sugar-beet factory at Chinook furnishes a ready market for beets. The beet tops can be used to fatten live stock. Our farmers can all be taken care of raising stock on dry land, raising irrigated crops, and feeding stock. Instead of being a liability to the Government, they will be an asset."

SUMMARY OF DEVELOPMENT IN UNITED STATES

A summary of the developments on the St. Mary and Milk Rivers in the United States will show that the irrigation facilities are sufficient to control the entire share of the United States of these two rivers, and possibly more, except during years of very high run-off. The Fresno Reservoir, situated in the Milk River Valley south of the Boundary, provides extensive regulation of the river flow at that point and with a constructed capacity of 126,000 acre-feet, is capable of impounding the average annual run-off of Milk River, which is estimated as 116,000 acre-feet at Eastern Crossing for the period 1922 to 1940, inclusive.

A comparison of Tables IV and V in the Appendix shows that the United States increased the use of its share of the water much more rapidly than Canada and particularly since completing the Fresno Dam in 1939. Table IV of the Appendix shows that during 1940 the United States used 91 per cent of its share of the two rivers.

IRRIGATION DEVELOPMENT FOR USE OF ST. MARY AND MILK RIVERS IN CANADA

Under the provisions of the North West Irrigation Act passed by the Parliament of Canada in 1894 extensive irrigation surveys were carried out by engineers under the Department of the Interior. Many of the projects now in operation in Alberta were developed from these early surveys. All water from St. Mary River that is used for irrigation in Canada is diverted through the works of the Alberta Railway and Irrigation Company, more commonly called the A.R. and I. Project. The areas irrigated include the Lethbridge and Coaldale Districts served by the original A.R. and I. works, and the Irrigation Districts of Taber, Magrath, and Raymond.

Application was first made by the Company on January 31, 1899 to divert from St. Mary River the total low-water flow available and a further quantity during high stages sufficient to make 2,000 second-feet at that stage. A memorial required under the provisions of the North West Irrigation Act was filed by the Company on February 7, 1899 and on May 3, 1899 authorization was granted to the Company to construct the necessary works.

By Order in Council dated May 22, 1899 the water reserved for the Company by a previous Order dated September 21, 1897 was granted to the Company as part of the quantity applied for in a memorial filed January 31, 1899.

As the Company's plans were developed the scope of the proposed works was enlarged and separate memorials and plans were filed covering the use of water from other sources than those comprised in the original application. Finally on September 9, 1902 amended memorials and plans were filed by the Company comprising all those previously submitted.

In the meantime, however, under provisions of the Reclamation Act passed by the United States Government in 1902, plans were developed to divert the St. Mary River in the United States to Milk River, thus threatening the water supply granted by the Government of Canada.

The Canadian Government protested the proposed diversion of the St. Mary River in the United States and the Company, in order to protect its water supply, proceeded with the construction of a diversion canal to divert from the Milk River in Canada any St. Mary River water turned into it by the United States Reclamation Service.

Negotiations which followed culminated in the Boundary Waters Treaty.

All the water rights granted to the Company, with the exception of those authorized on May 3, 1899 have since been cancelled and further development limited to the area served by existing works under the terms of the Treaty.

HISTORY AND DESCRIPTION OF ALBERTA RAILWAY AND IRRIGATION COMPANY

The present Alberta Railway and Irrigation Company Project was the first to be authorized under the North West Irrigation Act. This Company is an amalgamation of the Canadian North West Coal and Navigation Company's successor Company, the Alberta Railway and Coal Company and its subsidiary the North West Irrigation Company. The Canadian North West Coal and Navigation Company was organized in 1883 for the purpose of developing coal deposits discovered near the site of the present City of Lethbridge. It was planned to carry the coal, on barges, down the Oldman and South Saskatchewan Rivers, for transshipment to the main lines of the Canadian Pacific Railway at Medicine Hat. As the Oldman River proved unsatisfactory for navigation a narrow gauge railway was constructed from Lethbridge to Dunmore Junction, southeast of Medicine Hat. A similar railway was built from Lethbridge to Great Falls, Montana. The organization was renamed the Alberta Railway and Coal Company.

The construction of the railways was financed with British capital and the Company received a subsidy from the Dominion Government of about 14 million acres of land adjacent to its two lines. For the purpose of providing irrigation to aid in the disposal of this land the North West Irrigation Company was organized as a subsidiary of the Alberta Railway and Coal Company. An exchange of land was made whereby the Company was given title to a solid block of land in the western part of its holdings and title to the land near Medicine Hat was reverted in the Government. The newly formed Irrigation Company agreed to pay its parent organization \$2 per acre for the land.

The main works of the project were completed by the spring of 1901, and irrigation provided for about 600 acres near Lethbridge and about 3,000 acres in the Magrath District. Areas were irrigated near Stirling and Raymond the following year. The parent and subsidiary companies later amalgamated to form the Alberta Railway and Irrigation Company and in 1912 control of the organization was acquired by the Canadian Pacific Railway Company.

In 1902 authorization had been granted to the Company to divert additional water for irrigation and to purchase a tract of 500,000 acres of land east of its then holdings. The Company was allowed 15 years to complete the necessary irrigation works. The main canal, diverting water from the St. Mary River six miles north of the International Boundary, was located and originally designed by engineers of the Dominion Surveys and Irrigation Branch in 1895 to carry 500 cubic-feet per second, the amount of water first authorized for the Alberta Railway and Irrigation Project. The capacity of the canal was later enlarged to 1,200 cubic-feet per second. The Alberta Railway and Irrigation Canal now serves 127,600 acres of land comprising the original tract and subsequent extensions, including the Taber, Magrath, and Raymond Irrigation Districts. Because of inadequate water supply, the area irrigated is limited to 120,000 acres. Water is delivered by the Company to the headgate or headgates of each district and the districts are each responsible for the distribution of water to individual operators and for the maintenance and operation of the distribution system.

The development of irrigation on the Alberta Railway and Irrigation Project was not uniform throughout the earlier years since a few seasons of favourable rainfall early in the century led to the belief that dry farming and wheat growing were more profitable than the growing of irrigated crops. However, following the recurrence of several dry seasons and the successful introduc-

tion of alfalfa, substantial progress was recorded. By 1920, 82,000 acres of the irrigated land were reported occupied, and of this 12,000 acres were seeded to alfalfa. The project is now the centre of a rich agricultural area with irrigation in a dominant position.

TABER IRRIGATION DISTRICT

The Alberta Government passed the Irrigation Districts Act in 1915 and shortly thereafter an irrigation district was erected at Taber, the first by authority of the new Act. The newly organized District entered into a tentative agreement with the Canadian Pacific Railway Company whereby the Company was to construct all necessary works and take in exchange the bonds, issued by the District under authority of the Act, for an amount sufficient to cover the cost of construction. The time allowed by the Act for making provision for a water supply expired owing to difficulties encountered in connection with school lands. The district was re-erected in 1917 with the boundaries amended to exclude all school lands and to include additional areas to the east to make up the 17,000 acres for which water was considered available.

Early in 1919 the Board of Trustees effected an agreement with the Canadian Pacific Railway Company for the delivery annually of 34,000 acre-feet of water to irrigate the above mentioned area. Twenty-five thousand, five hundred acre-feet would provide 18 acre-inches annually but an extra amount of 8,500 acre-feet was obtained to provide for seepage and evaporation. In operation it was found that there was a surplus of water and an additional 4,662 acres in the Chin and Jamieson areas were added to the project in 1929. A further 5,149 acres of abandoned school lands were acquired from the Federal Government at a price of \$1 per acre and were included in the project.

The cost of the works to irrigate the original 17,000 acres, \$272,000, was provided by the sale of a thirty-year, six per cent bond issue with title to the 17,000 acres as security. No payments of principal were required during the first ten years of the period of the bonds so that the farmers might divert all available income to the adaptation of their farms to irrigation. Their full repayment was to be made in twenty equal annual payments. This deferment of capital repayment was justified in operation as it was found that, in the Taber District, at least ten years was required to prepare the land, construct efficient facilities for irrigation and drainage, and acquire additional equipment necessary for irrigation farming.

The cost of the Chin and Jamieson Extension irrigation works together with the price of the 5,149 acres purchased from the Government totalled \$33,142.

The irrigable portions of the 5,149 acres of purchased land in the Chin and Jamieson Extension were sold by auction, the terms providing for a payment of 10 per cent at time of sale followed by nine equal annual payments. Sales of this purchased land, after deducting the cost of its development, resulted in a profit to the District of \$96,509 in the first twelve years after purchase.

This surplus reduced the bonded debt on the original 17,000 acres from \$16 to \$12.59 per acre. During the depression four of the annual payments of principal were deferred but as of July, 1941, seven, totalling \$92,200, had been collected, further reducing the bonded indebtedness to \$8.21 per acre. In 1935 the annual interest rate was reduced from six to five per cent.

Taber Irrigation District has proven an outstanding success because of its ample water supply and low capital and operating costs.

The Alberta Railway and Irrigation Company Project adjoins Chin Coulee and the Coulee provides a natural reservoir for the surplus water from the Project. No part of the cost of the works to convey the water to Chin Coulee was assessed against the Taber Irrigation District and the reservoir ensures against the adverse effect of low water in the St. Mary River.

The annual irrigation rates required to finance the capital investment and maintenance and operation costs have varied from \$1.50 to \$2.60 and averaged slightly less than \$2 per acre since 1920 when the project was put into operation.

MAGRATH IRRIGATION DISTRICT

In 1922 residents in the Magrath area voted in favour of organizing an irrigation district which was erected as the Magrath Irrigation District in 1926 under authority of the Alberta Irrigation Districts Act. The district is located in Townships 5 and 6, Ranges 22 and 23, West of the 4th Meridian, and includes a total area of 17,942 acres. Of this area, 6,935 acres are served by irrigation, including some 1,980 acres in the immediate vicinity of the Town of Magrath served by the original works of the Alberta Railway and Irrigation Company. The newer portion of the District lies to the west of the town towards the St. Mary River and was first irrigated in 1926 after the district had been erected for the purpose of bringing water to the lands not included among the water agreements with the Alberta Railway and Irrigation Company. The system was designed to provide a maximum of 40 acres to each quarter-section of land.

Under the terms of agreement between the Alberta Railway and Irrigation Company and the District, the Company constructed the necessary additional distribution works and agreed to supply, at the District's headgate, 30 cubic-feet of water per second during the irrigation season, diverted from St. Mary River. The District agreed to pay the Company the sum of \$120,000 for water rights which represented a proportion of the cost of constructing the A.R. and I. canal system, and to pay an additional sum to the Company of \$80,000 to cover the cost of constructing the additional distribution works, making a total capital cost to the District of \$200,000, or over \$40 per acre for the new lands irrigated. The Company accepted the District's debentures for this amount payable in twenty-eight equal instalments and bearing interest at the rate of 6 per cent per annum. In addition, the District agreed to pay the Company the sum of \$3,375 annually for carriage rights or at the rate of \$112.50 per cubic-foot per second of water carried and amounting approximately to an annual water rental charge of 66½ cents per irrigable acre. To provide for the total annual payments, comprising capital charges, water carrying charges and additional sum for maintenance and operation, required a levy of \$5 per irrigable acre per annum.

The growing of sugar beets in the area adjacent to the Town of Magrath where the original annual rates are levied provides a return adequate to meet these rates but, in the western portion of the District, where the higher annual rates prevail and where because of rolling land crops are limited to hay and grain, the returns during the past decade have proved inadequate. For this reason the District has not been able to keep up its payments to the Company under the terms of the agreement and is now greatly in default.

RAYMOND IRRIGATION DISTRICT

The Raymond Irrigation District was erected in March, 1925, and comprises an irrigable area of 15,129 acres in Township 6, Ranges 19, 20, and 21, West of the 4th Meridian, and west of the Town of Stirling. Of this area 8,688 acres were already under water agreement as part of the original Alberta Railway and Irrigation Project and works were constructed within the District to serve an additional 6,441 acres of new lands.

The A.R. and I. Co. agreed, in consideration of the payment of \$160,000 to deliver 40 cubic-feet per second of water during the irrigation season to headgates constructed and maintained by itself at suitable points along its canals. The District agreed to maintain, repair, renew and operate all works within its boundaries and to assume the Company's obligations for the maintenance and operation of all works therein.

In addition to the purchase price for water, the District agreed to pay the Company an annual water rental of \$4,500 and undertook as agent for the Company to collect the rental on those lands included in the District which held water agreements with the Company and pay to the Company the sum of \$112.50 for every cubic-foot per second of water covered by such agreements.

TOTAL AREA IRRIGATED FROM ALBERTA RAILWAY AND IRRIGATION SYSTEM

The records of the Alberta Water Resources Office show that the irrigable area within the A.R. and I. Project is 127,600 acres. The actual area under water agreement is somewhat less than 120,000 acres because sufficient water for a greater area is not always available when required. More land could be irrigated from the system as constructed if a reservoir were provided to store water for use during low water periods on the St. Mary River. Below are listed the irrigable areas within the projects served by existing works:—

A.R. and I. Project—Lethbridge-Coaldale Area	84,000 acres
Magrath Irrigation District	7,000 "
Raymond Irrigation District	15,100 "
Taber Irrigation District	21,500 "
Total	<u>127,600 acres</u>

COST OF CONSTRUCTION AND METHODS OF FINANCING

The Alberta Railway and Irrigation Project was financed entirely without Government assistance other than certain land grants given to the Company for railway development. According to information available \$2,133,851 has been expended on the main project. This figure no doubt includes a considerable amount expended for improvements.

The Company also constructed and financed three irrigation district extensions served from the Alberta Railway and Irrigation works, Taber, Magrath, and Raymond. In each case the Company accepted as security bonds issued by the Districts under authority of the Alberta Irrigation Districts Act.

The total expenditure on the Taber District was \$308,368 including the cost of the Chin Reservoir. Two hundred and eighty thousand was expended on the Magrath District and \$166,000 on the Raymond District. The capital expenditure for irrigation on the total area of 127,600 acres averages slightly more than \$21 per acre.

EXTENT TO WHICH CANADA USES ITS SHARE OF MILK AND ST. MARY RIVERS

The use of water from the Milk River for irrigation in Canada is limited entirely to a few small individual projects along the river and its tributaries. Topographical features would permit of the utilization of all of Canada's share if the necessary diversion and storage facilities were provided.

Canadian use of the St. Mary River is limited by the 1,200 second-foot capacity of the diversion works and consequently the portion of Canada's share of the high water flow in excess of this capacity is not utilized. For the period 1922 to 1940 the average annual natural flow of St. Mary River at the Boundary amounted to 611,300 acre-feet of which Canada's share was 362,000 acre-feet. Of this share Canada used only an average of 163,200 acre-feet or 45 per cent because of lack of storage facilities.

DEFICIENCY OF WATER SUPPLY ON EXISTING PROJECTS AND NEED OF STORAGE

Owing to the lack of storage facilities Canada is not only wasting an average of 55 per cent of its share of St. Mary River, but water users on the projects served from this river are suffering heavy losses through water shortages during the months of July, August, and September, when the river flow is at a low stage. The Committee was not able to determine or confirm the extent of the

losses suffered but during low run-off years such as 1936 and 1940 the deficiency amounted to more than 32,000 acre-feet or the equivalent of about 40 per cent of normal requirements during this critical period.

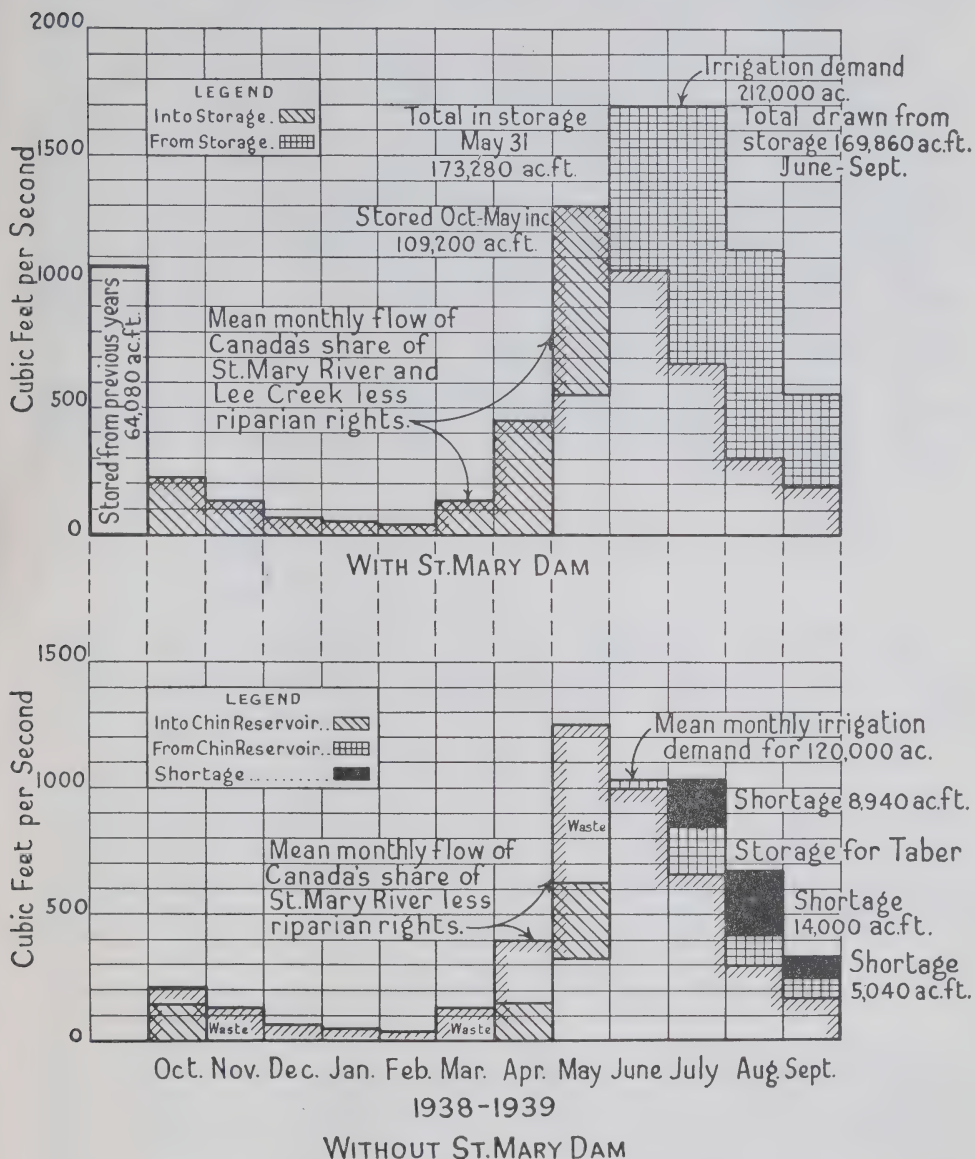
The deficiency of water supply on existing projects served from St. Mary River is shown in detail in Table VI. This table lists only the months of July, August, and September as the study showed no shortages in May and June. Table VI is summarized as follows:—

Month	Shortage Occurred	Average Shortage for 14 Years	Greatest Shortage	Average Shortage
		Acre-Feet	Acre-Feet	%
July.....	9 years out of 14	5,302	19,200	11
August.....	12 years out of 14	9,521	17,400	29
September.....	9 years out of 14	2,452	6,900	15

The studies summarized in this table are based on a full legal duty of 1.5 acre-feet per acre for the area of 98,400 acres not provided with reservoir facilities. The studies assumed a flow of 30 cubic-feet per second for riparian rights.

The chart on the next page illustrates the necessity of storage.

HYDROGRAPHS OF CANADA'S SHARE OF ST. MARY RIVER SHOWING EFFECT OF ST. MARY DAM ON THE WATER SUPPLY



The proposed reservoir of 270,000 acre-feet capacity on the St. Mary River would not only eliminate the deficiencies on the existing projects, but would also provide water for an additional 94,000 acres. Losses from water shortages now suffered by the water users particularly in the production of sugar beets and alfalfa would be eliminated and water would be available for the full agricultural development of lands served by existing works.

WATER SUPPLY AVAILABLE FOR FURTHER DEVELOPMENT

This area includes 120,000 acres now irrigated from the St. Mary River, 94,000 acres which may be irrigated from the same stream and 18,000 which may be irrigated from the Milk River. To irrigate areas in excess of this acreage, additional water would be required. This may be obtained from the Belly and Waterton Rivers.

The combined discharge of these two streams for the years 1927 to 1940 inclusive averaged 675,170 acre-feet and of this the Belly River contributed 219,513 acre-feet and the Waterton River 455,657 acre-feet.

Three irrigation districts now divert water from the Belly River and water is reserved for a fourth, the proposed Aetna Project. Further use of the waters of this stream is limited to what may be economically obtained by direct diversion as extensive storage is impracticable. A canal to divert 600 cubic-feet of water per second or 97,506 acre-feet per year is regarded as most suitable.

Two hundred and eighty-two thousand, eight hundred and forty acre-feet annually would be diverted from the Waterton River to the proposed St. Mary Reservoir if storage for 28,000 acre-feet were provided on the Waterton River with a diversion canal of 1,100 cubic-feet per second capacity.

The combined flow of Waterton and Belly Rivers plus Lee Creek, together with Canada's share of St. Mary and Milk Rivers, averages 1,117,350 acre-feet annually while the combined flow which would be available for use with the facilities proposed is:—

St. Mary River	386,000	acre-feet
Milk River	29,000	" "
Belly River	98,000	" "
Waterton River	283,000	" "
Total	796,000	" "

This 796,000 acre-feet annually is considered sufficient for the irrigation of 465,000 acres of land. Assuming a legal duty of water of 1.5 acre-feet and an irrigation factor of 80 per cent and estimating transportation losses at 33 per cent, the annual irrigation requirements of 465,000 acres of land would be 830,000 acre-feet.

This would indicate an average deficiency of 35,000 acre-feet annually, or that the water supply is sufficient to provide 1.4 acre-feet instead of a full legal duty of 1.5 acre-feet per acre. In view of the liberal allowance provided for losses; the adequate number of reservoirs that may be provided to conserve run-off from various drainage basins; and the fact that existing projects show an average long term use of 1.35 acre-feet per acre, it is considered that the water supply would be sufficient to serve 465,000 acres.

EFFECT OF DIVERSIONS ON SOUTH SASKATCHEWAN RIVER

The Waterton, Belly, and St. Mary Rivers are all tributaries of the South Saskatchewan River which flows through Saskatchewan and empties into Lake Winnipeg in Manitoba. Any diversion from these tributary streams for irrigation therefore will diminish the flow of the South Saskatchewan River by the quantity diverted, less the amount of return flow to the streams. As a large portion of the irrigable area slopes towards the rivers the return flow will be considerable. Thus ultimate effect of the development of irrigation, however, will be to diminish the annual flow by approximately 700,000 acre-feet. The average annual flow of the South Saskatchewan River at Medicine Hat is approximately 5,850,000 acre-feet and the low flow 2,470,000 acre-feet. The diminution of flow in years of average precipitation would be approximately 12 per cent and in years of low precipitation 28 per cent.

However, in view of the large reservoir capacity provided, a large quantity of the water diverted would be from high and flood flows and the effect on the low water flow would be small.

In the ultimate development the storage reservoirs may prove beneficial in providing some protection against floods in the South Saskatchewan River. However, until a great many additional reservoirs are constructed on the streams in Alberta the effect on the extreme floods will be slight.

HISTORY OF ADJOINING IRRIGATION PROJECTS

According to information furnished by the Alberta Water Resources Office, 508,800 acres of land are served by the existing works of the large irrigation projects in the Province not including the Leavitt Project now being constructed. In addition, 69,561 acres can be irrigated from 595 private schemes. At the end of 1939, 4,379 irrigation farmers were operating an area covered by water contracts of approximately 507,000 acres according to information obtained by the Economics Division in a survey of the eleven large projects in the Province.

In the irrigated areas the average farm is a quarter-section of 160 acres of which 120 acres is irrigation and 40 acres not adapted to irrigation. Other farms vary from 10 acres to more than 1,000 acres with an over-all average of 116 acres of irrigable land per farm.

The survey included the following eleven projects:—

1. Eastern Irrigation District
2. Lethbridge Northern Irrigation District
3. Canada Land and Irrigation Company
4. United Irrigation District
5. Raymond Irrigation District
6. C.P.R. Western Section
7. C.P.R. Lethbridge Section (A.R. and I.)
8. Magrath Irrigation District
9. Taber Irrigation District
10. New West Irrigation District
11. Mountain View Irrigation District.

The information obtained from project officials showed that in the eleven districts probably only 56 farms were available for sale. Few of these were vacant and any purchasers would require considerable capital. A few farms, considered to be submarginal, were rented for pasture. The Report of the Economics Survey implied that new projects or extensions of existing projects must be developed or the size of the individual holdings reduced if the number of farmers on irrigable land is to be increased. Some districts reported a relatively small additional acreage which could be irrigated from existing works at a fairly low cost.

The existing irrigation works in Alberta are designed to irrigate 1,000,000 acres. Actually distribution facilities have been constructed to irrigate only about one-half of this area. This reduction is largely due to the withdrawal of part of the Western Section of the Canadian Pacific Railway Irrigation Project east of Calgary where relatively heavy rainfall reduces the value of irrigation. In addition, the reclassification of land in various projects has reduced the irrigable area. This reduction has been very substantial in some projects such as the Eastern Irrigation District where the irrigable area was greatly over-estimated at the time of construction as indicated by the fact that much less than half of the estimated 400,000 acres has proven economical of development. In most other projects the reduction in acreage has been relatively small. The

significant fact is that little more than one per cent of all irrigated farms in the province are available for purchase and that unless additional irrigation facilities are provided any extension of large scale irrigation development is at an end.

The histories of the projects served from St. Mary River have already been given. The histories of other projects in the Province follow. These have been supplied by the Alberta Water Resources Office with the exception of that of the Canada Land and Irrigation Project which was prepared by Mr. D. W. Hays, its General Manager. Table IX in the Appendix gives a summary of irrigation development in Alberta showing the projects, source of supply, miles of canal, areas in tracts, irrigable areas from existing works and the areas actually irrigated during the period 1936 to 1940 inclusive.

EASTERN IRRIGATION DISTRICT

In 1903, the Canadian Pacific Railway Company selected a large block of land between Calgary and Medicine Hat as part of its land grant, and developed it for irrigation. The Company spent \$18,000,000 on the construction of works to irrigate the western and eastern sections of this block. Works have not been constructed for the central section.

The Company in order to create or increase traffic for its railroad provided irrigation for this land which though fertile was considered too dry for settlement. It was expected to recover the cost of the development from the sale of the land.

The Company also expected that the land under the irrigation systems would be sold in a few years' time, whereupon in accordance with the water agreements issued to the purchaser it intended to turn over the irrigation system to the water users to be operated by them.

The Eastern Section, which comprises an area of about 1,500,000 acres, extends from Range 11 on the East to Range 18 on the West both inclusive, and from the Red Deer River on the North to the Bow River on the South. It was opened for settlement in the spring of 1914, and the first irrigation water was delivered that year.

Adverse economic and agricultural conditions during and following the war deterred rapid settlement of the area. Those who did purchase land could make a fair living but could not pay for the irrigation works.

It was later suggested that the company relinquish its claim for the cost of the irrigation works and transfer the works to the landowners thus giving them an opportunity to operate the irrigation system as a co-operative enterprise. Out of the discussions that followed, grew an agreement ratified by the Provincial Legislature, whereby the railway company in 1935 transferred to the Board of Trustees of the Eastern Irrigation District, which had been formed under the Provincial Irrigation Districts Act, all the irrigation works, land contracts and unsold lands in the district, together with \$300,000 as a capital reserve for the replacement of large structures.

Of the 1,500,000 acres transferred to the Eastern Irrigation District about 200,000 acres are irrigable land, and with the exception of a small area in the western portion operated as dry land farms the remainder is only suitable for grazing. A large portion of the irrigable land was held by farmers under agreements of sale at prices ranging from \$25 to \$50 per acre. These prices were considered excessive by the Board of Trustees of the new irrigation district and one of its first acts was to reduce all contracts for the purchase of irrigable land to an amount which would give the farmer a reasonable assurance of eventually owning his home in the district. The general policy adopted in this revaluation was to revise the contract by fixing the price of land at approximately one-fifth of the price stipulated in the contract with the railway company, assuming the value of the best irrigable land of the district at not more than \$10 per acre.

All past-due indebtedness of the settlers was cancelled when the contracts were re-issued. Thus the price of the land and annual payments were reduced to a very moderate sum.

The Railway Company had established a charge of \$1.25 per acre of irrigable land for the operation and maintenance of the irrigation works. This did not fully meet these costs so in 1935 the Board of Trustees increased this service charge to \$1.75. In 1936, 1937, and 1938 the same rate was levied. In 1939 and 1940 the service charge was \$1.60 and in 1941 it was \$1.70 per irrigable acre. In each of the four years, 1935 to 1938, the cost of operation and maintenance was less than the levy and surpluses resulted. In 1939, when greater maintenance work was required, there was a deficit, but in 1940 there was a small surplus and it is expected that there will be a small surplus again in 1941.

In 1937, by an arrangement with the Prairie Farm Rehabilitation Act Branch of the Federal Department of Agriculture an additional 25,000 acres in the Rolling Hills area were provided with works for irrigation and settled by farmers from drought areas of Saskatchewan. With the very reasonable prices placed on the lands, there has been little difficulty or expense in settling the small area of vacant lands or in re-settling any lands that later became vacant.

The District has not found it necessary to expend any part of the \$300,000 received from the Railway Company. Although the collection of service charges has been adversely affected by low prices for farm products the financial condition of the District has improved since 1935. Any advance in the prices of farm products would result in further improvement.

Even though the Canadian Pacific Railway Company did not recover the cost of the irrigation works and suffered a loss on the operation of the works, the prime objects of the project, namely, agricultural development and traffic, have to a large extent been accomplished.

The country and the province have also benefited greatly by increased production and population in this area where without irrigation there could be very little production and only sparse settlement.

CANADA LAND AND IRRIGATION COMPANY PROJECT

This company was formed in 1917 through the amalgamation of three predecessor companies. The property acquired in Canada was valued at £2,416,561 and consisted of 532,894 acres of land (of which about 200,000 acres were considered irrigable); a partly completed system of irrigation works and a considerable number of buildings, construction equipment, live stock, and agricultural implements.

The Company proceeded with the development of irrigation works and first delivered water in 1920. By 1924 the Company was only providing water to 10,600 acres of its original holdings and to 4,501 acres in the New West Irrigation District and receivership proceedings were instituted against it. A receiver was appointed and at his request the Federal Department of the Interior agreed to operate the project until a settlement was reached.

It was apparent that resumption of operations by the Company would depend upon (a) the settlement of the debt of the predecessor companies for land acquired from the Federal Government (b) payment of arrears of taxes owing to the Province of Alberta and (c) sufficient working capital to provide for the gradual enlargement and extension of the irrigation works to permit of the sale of the necessary land, estimated at 50,000 acres to provide sufficient revenue for profitable operation.

The scheme adopted resulted in agreements with the Dominion and Provincial Governments by which debts were to be liquidated by the transfer of lands. The effect of these agreements, subsequent adjustments and tax pro-

ceedings on lands sold by the Company resulted in depletion of the Company's land-holdings to approximately 225,700 acres. Of this area it is estimated that about 100,000 acres is irrigable.

The Company resumed operations in July, 1927, and extended the irrigation works to irrigate 30,000 acres in 1930. Difficult economic conditions in the years 1931 to 1936 prevented further development, but additional irrigation extensions have since been completed. These extensions have resulted in an increase of the irrigated area to 52,500 acres.

The project, situated in the driest and warmest section of Alberta, contains lands of excellent quality for the growing of corn, beans, and various seeds, when irrigated. Crop production has been largely wheat but in recent years the raising and feeding of live stock and the growing of canning crops and seed is becoming general. The project is somewhat handicapped by its distance from markets.

The price of irrigated land averages \$25 per acre and payment may be made in 25 equal annual instalments of \$1.77 which includes interest at 5 per cent per annum. The annual charge for maintenance and operation is \$1.50 or a total annual charge of \$3.27. Payment may also be made on a crop share basis of one-quarter of the hay and grain produced, one-sixth of the corn, beans and seed crops and one-tenth of the beet, potato and other root crops. The proceeds from the sale of the share of crop is applied, first, to the operation and maintenance charge, or "Water Rental" and next to reduce the principal and interest. Although the proceeds vary with the prices obtaining at the time of marketing the various crops, the system has proven satisfactory because of its elasticity.

The average annual collections per acre of land cropped and irrigated in the six years, 1936 to 1941, was \$2.89. Because of the gradual development of the project, some part of the land being summer-fallowed each year, and to other factors, only an average of 80 per cent of the land was cultivated during each of the six years, 1936 to 1941.

The average prices obtaining during the period were—wheat 68 cents, oats 24 cents, and barley 36 cents per bushel, and alfalfa hay \$5.30 per ton.

LETHBRIDGE NORTHERN IRRIGATION DISTRICT

The Lethbridge Northern Irrigation District is an irregular tract of bench land on the north side of the Oldman River between Macleod on the west and Turin on the east. The District contains about 230,000 acres of which about 95,000 acres are irrigated. The main canal is 53 miles long and has a capacity of 800 cubic feet per second. There are about 600 miles of secondary canals, and distribution and drainage ditches. Substantial works were constructed and these have always been well maintained.

The erection of the District followed the dry years of 1910 and 1914 when some of the settlers on the area petitioned the Federal Government, which administered the natural resources at that time, to investigate the possibility of irrigating their lands which while fertile did not receive sufficient rainfall.

After investigation and survey, the best method was decided to be the diversion of water from the Oldman River at a point west of Macleod.

An Irrigation District was erected under the Provincial Irrigation Districts Act in October, 1919. A bond issue, guaranteed by the Provincial Government, and totalling \$5,400,000, was sold early in 1921. Construction was completed by the spring of 1923 when an unprecedented flood on the Oldman River destroyed the works. These were restored later in the year and put into operation in the spring of 1924. They have been in use each year since that time.

The money obtained from the sale of the bonds was expended on the original construction and the repairing of the flood damage. It, therefore,

became necessary to obtain funds to provide for operation and maintenance. This was loaned by the Provincial Government. In 1924 the first levy was made on the land-owners. It was \$1.48 per irrigable acre for service charge and \$3.77 per irrigable acre to pay interest, exchange, etc., on the bond issue, a total of \$5.25 per acre. It soon became apparent that the farmers could not pay these rates and an appeal was made to the Provincial Government.

Early in 1925 Dr. John A. Widstoe was retained by the Provincial Government and he recommended that the Government give temporary financial assistance and hasten the colonization of the vacant lands.

This assistance not proving adequate a second commission composed of Professor M. L. Wilson, Dr. W. H. Fairfield, and Mr. L. C. Charlesworth was appointed in 1930. This commission recommended that the Provincial Government assume part of the cost of construction and service charges.

With the great reduction in the price of farm produce in the early '30s, assistance again became necessary and a third commission composed of Judge A. F. Ewing, Dr. F. A. Wyatt, and Mr. Roi W. Risinger was appointed by the Government in 1936 to determine the value of irrigated lands on this and other irrigation projects in the Province. The general findings of the commission are summarized elsewhere in this Report. On the recommendation of this Commission, the Government assumed an additional portion of the construction costs of the Lethbridge Northern Irrigation District.

Because of high construction costs obtaining when the project was developed, the cost of the works averaged \$55 per irrigable acre. On the recommendation of the Ewing Commission the Provincial Government assumed an additional portion of the construction costs so that they were reduced to \$17 per irrigable acre. Repayment of this amount, plus operating charges, by farmers growing beets or other specialized crops is proving possible, but where wheat only is grown, payment is difficult.

A summary of the contributions and expenditures to date by the Provincial Government on behalf of the Lethbridge Northern Irrigation District follows:—

Rates	\$7,860,924 43
Less repayments	1,758,962 07
	<u>\$6,101,962 36</u>
Colonization expense	435,405 53
Arrears of taxes	114,157 97
Reclassification of irrigable areas	9,732 40
Land purchases	7,674 17
Drainage of lands	185,600 94
Reservoirs and preventing of seepage	151,705 97
Total	<u>\$7,006,239 34</u>

On the recommendation of the Colonization Manager, most of the farmers on the project have assigned a fifth of their crops to the Provincial Government to apply on the rent, rates, and payments owing on their lands. So long as average yields are obtained this share will meet the charges against the land. On this basis collections during recent years have been as follows:—

Year	1937	1938	1939	1940
	\$ cts.	\$ cts.	\$ cts.	\$ cts.
Rates and Rent.....	139,680 42	142,405 09	124,460 59	113,726 82
Payment on Contracts.....	77,501 78	98,953 59	104,782 89	103,888 93
Totals.....	217,182 20	241,358 68	229,243 48	217,615 75

Under the present plan, the farmers are to pay the service charge (operation and maintenance) and to refund about \$1,500,000 of the capital expenditure to the Provincial Government. This leaves a balance of interest and sinking fund payments for the Provincial Government to pay each year until the bonds are retired in 1951. As shown, this has totalled over seven million dollars to date.

Before this area was irrigated, wheat growing and ranching were the only occupations. Because of frequent shortages of moisture, yields were small and uncertain. Since the introduction of irrigation, a wide variety of crops are grown. Even with the present low prices of grains, the value of the gross production of wheat, coarse grains, alfalfa and other hay, potatoes, sugar beets, peas, and beans was about \$1,675,000 in 1940. This does not include meat, dairy products, poultry products, live stock, garden produce, seed, etc., of the value of which there is no definite record but which have increased very much in recent years. It is also estimated that 6,000 head of cattle and 22,000 head of sheep and lambs which had been raised on ranches outside of the District, were fed and finished in the District during the winter of 1940-41. In 1936, ranchers, who because of the drought had neither pasture nor fodder, wintered over 4,000 head of cattle in the District.

In 1924, when the Lethbridge Northern District was first irrigated there were only about 300 families in the area. Now about 900 families occupy farms on the project. Belts of fine trees shelter small fruits, flowers, and vegetables which grow in abundance. It is estimated that the project directly supports 10,000 people. A railway parallels a gravelled highway to Lethbridge and power lines bring the conveniences of the city to the farms. At Picture Butte, near the centre of the district, there is an up-to-date sugar factory, beautiful homes, trees, and green boulevards. A few miles west of Picture Butte is Park Lake, now a provincial park, with ornamental and shade trees, a beach, dressing rooms, playground equipment, stoves, picnic tables, and benches. A few years ago all this was treeless, waterless, drought scorched prairie.

MOUNTAIN VIEW IRRIGATION DISTRICT

The Mountain View Irrigation District, the smallest organized under the Alberta Irrigation Districts Act, is located seventeen miles west of Cardston. It comprises 3,500 acres of irrigable land in some 50 parcels in Townships 2 and 3, Ranges 27 and 28, West of the 4th Meridian, between Mami Creek and the Belly River. The irrigable lands located in the north portion of the district have a regular, even surface and are suitable for the irrigation of hoed crops. The south portion, however, includes irrigable areas which are rolling and steep, and crops on these lands are almost entirely limited to grasses which form a sufficiently strong sod to withstand the erosion which generally accompanies irrigation on steep slopes.

The formation of the district was authorized by a Minister's Order, dated August 2, 1923, but it was not until 1932 that the canal and works were in a suitable condition to deliver water to the irrigable lands. Since that time irrigation has been general and good results have been obtained.

The financial policy of this District differed from that of other irrigation districts erected under the Alberta Irrigation Districts Act. Districts erected under this Act, in general, pay for the cost of construction of the irrigation works out of the proceeds of bond issues having the lands irrigated as security. Each member of the Mountain View Irrigation District agreed to provide labour and materials in the proportion that his irrigable acreage bore to the total irrigable acreage of the District, thereby avoiding the incurring of an encumbrance on the title to his land. This has proved reasonably satisfactory although some members have endeavoured to evade their full responsibility to the District.

As originally enacted, the Alberta Irrigation Districts Act did not contemplate the construction of works by the method adopted by the Mountain View District, and, in order that the Act could be applied to this method, the necessary revision was made in 1925.

The financial policy of this District probably had some bearing on the length of time taken to complete its works, but climatic conditions also contributed to the many delays which occurred. The construction period included several years when the need of irrigation was not acutely felt in this area, and it was consequently difficult to create any enthusiasm for work connected with irrigation. The construction of a diversion canal along a steep sidehill section of the Belly River Valley and thence to the District, which was necessary to bring the water to the irrigable lands, appeared to be an endless task and caused many difficulties in organizing the necessary labour. This resulted in an incomplete canal system of limited capacity.

A more or less inadequate supply system was operated until the autumn of 1937 when the Prairie Farm Rehabilitation Act Branch, Department of Agriculture, came to the District's assistance with a grant of \$3,000. These funds enabled the District to enlarge the canal quickly and efficiently.

A policy of community development may not have much practical value in meeting the requirements of a large irrigation unit, but, in the case of the Mountain View District, the policy of maintaining debt free lands has had some decided advantages. It has made it possible for this District to operate successfully with very small demands on its ratepayers. During the first seven years of operation an annual charge of 30 cents per irrigable acre was sufficient to operate the system and discharge a bank loan of \$1,500 and some outstanding labour accounts. The District is now operating on the returns received from an annual charge of 20 cents per irrigable acre.

Before irrigation, stock-raising was the principal occupation of the settlers. Irrigation has resulted in greatly increasing the number of stock in the District as the rolling areas, formerly only suitable for pasturage, now contain a succession of hay fields. This crop, stacked in the fields, provides ample feed for the winter months.

LEAVITT IRRIGATION DISTRICT

The Leavitt Irrigation District includes approximately 4,500 acres of irrigable lands in Townships 2 and 3, Ranges 25, 26, and 27, West of the 4th Meridian. A portion of the town of Cardston is included in this district which extends westward from the town for about eight miles and includes an area between Lee Creek on the south and the Blood Indian Reserve on the north. Approximately one hundred quarter-sections have been classified as including irrigable lands, and in general they may be described as steep and rolling. The District was organized under a Minister's Order, dated October 29, 1936, but construction of the distribution system was not commenced until September, 1939, and these works are not yet completed.

The Leavitt District receives its water supply from the Belly River, delivery being made through fifteen miles of canals and reservoirs before reaching the irrigable lands. A combined diversion for this and the Mountain View District is made from the Belly River to Driggs Lake Reservoir through a canal constructed and operated by the Mountain View District. Driggs Lake Reservoir was constructed in 1939 by the Dominion Government through its Prairie Farm Rehabilitation Organization; it supplies a storage basin for both Districts. From the reservoir, the water for the Leavitt District follows the natural channel of Mami Creek for a distance of about one and one-half miles and is then rediverted into a canal extending eastward for a further distance of nine miles where delivery is made to the irrigable lands. This

canal from Mami Creek to the District's boundary includes two small storage reservoirs, and, as in the case of Driggs Lake Reservoir, this supply canal and reservoirs were built by the Dominion Government in 1939.

The Leavitt District is not required to reimburse the Dominion Government for its expenditures in bringing the water from the Belly River to the westerly boundary of the District. These expenditures totalled \$62,880.

The Leavitt District has the responsibility of constructing the canals and works which are required to distribute irrigation water to the one hundred parcels which it includes. This represents approximately 36 per cent of the total cost of the Project. As was done by the Mountain View District, the Leavitt District landowners agreed to carry out their own construction work, and adopted a financial policy which excluded the bonding of their lands. Immediate cash requirements were provided by a loan of \$5,000 from the Provincial Government on notes of District members. This loan enabled the District to purchase equipment and construction material. The purchases of equipment were at first confined to excavating machinery and structural materials not available from members of the District. It was later found that it was not practicable to have each individual supply his proportionate share of the District's timber requirements, and further, that the District's funds were insufficient to permit the purchase of all the timber that would be required. As a means of obtaining cheap lumber, the District borrowed \$600 from the Provincial Government, purchased a portable sawmill, and, in the winter of 1940-41, organized a crew of men to operate it. This organization cut and sawed sufficient timber to supply the District's 1941 construction requirements, and provided a surplus which was sold.

The timber operations have justified the borrowing of the money and it is considered that their continuation for a further period is warranted. From the sale of surplus timber, the District hopes to pay off the outstanding loans and to realize sufficient funds to take care of its cash requirements until irrigation is in operation and the District members are able to pay for operating and maintaining the water supply system.

The construction assessment which the District has made on its members, for work and materials, for each irrigable acre has been made on the basis of the following items:

100 f.b.m. timber at \$25 per M.f.b.m.....	\$2 50
25 cu. yds. excavation at 20c. per cu. yd.	5 00
1 cu. yd. rock at \$1.00 per cu. yd.....	10
Charge for hardware	10
Total	\$7 70

The cash equivalents of the different items above are included because the Act permits District members to pay water right charges in cash if they desire this method of payment in preference to performing the work and supplying the materials.

Construction work on the District's distribution system was carried out during periods of limited agricultural activity. Work has proceeded during three successive years and is approximately 65 per cent complete.

UNITED IRRIGATION DISTRICT

The United Irrigation District includes all the area between the Belly and Waterton Rivers north of the third tier of sections in Township 3, Range 27, West of the 4th Meridian. The District contains approximately 63,000 acres, of which 34,000 acres can be irrigated.

The altitude of the land varies from 3,870 feet above sea level at the south end of the District to 3,250 feet at the north end. This difference in elevation of 620 feet and its proximity to the mountains gives the impression that the area

has very steep slopes. Although the slopes are somewhat steeper than usual for irrigated lands much of the descent occurs in narrow strips, and the slope of the greater part of the land is sufficiently gradual to permit of irrigation. Temperatures are lower and periods of growth shorter than in the irrigation districts at a lower elevation. Although good yields of wheat are produced, the area is better adapted to the growing of coarse grains, alfalfa, grass, and the hardier varieties of vegetables. Sometimes satisfactory returns are obtained from sugar beets, but contracts for suitable areas of this crop cannot be obtained from the sugar manufacturers because of the uncertainty of delivery.

This District includes part of one of the first large ranches established in southern Alberta, the Cochrane Ranch. The site of the ranch was selected because of the abundant growth of grass and plentiful supplies of water from the two rivers and numerous sloughs and small lakes. Notwithstanding the many advantages of the ranch site, evidence of the occurrence of drought periods is found in the construction in 1894 of a ditch to carry water from the Belly River to irrigate land near the ranch-house, probably to ensure a supply of hay. The construction of these works was carried out by some of the early settlers of Cardston who had experience with irrigation in their home State of Utah.

The Cochrane Ranch was later purchased by the Church of Latter Day Saints for colonization purposes. The settlers, who were placed on these lands by the Church, evidently also experienced drought conditions in the early years of their settlement, as they made application to the Dominion Government for the irrigation of their lands. The diversion of water from the Waterton River for this purpose was authorized in May, 1907, but from the preliminary surveys made at that time, it was found that the cost of this diversion would be excessive, and the authorization was cancelled in September, 1910. In spite of this setback, the idea of irrigating these lands persisted and it was proposed to extend the boundaries of the area to which irrigation would be applied. The settlers organized the United Irrigation District, and other settlers on adjacent lands to the north organized the Lone Rock Irrigation District.

It was proposed to irrigate both these Districts by diversions from the Belly River instead of the Waterton River and preliminary surveys by the Dominion Government proved the feasibility of the project. In 1918 drought conditions with attendant poor crops resulted in the farmers, without authority from the Government, commencing the excavation of a diversion canal. Only a small proportion of the work was completed when it was abandoned because of the influenza epidemic.

In 1919 the Dominion Government completed surveys for the irrigation of the United and Lone Rock Districts by a diversion from the Belly River. These surveys showed that it was practicable to divert water from this stream for the irrigation of the two Districts and that additional lands to the north of the Lone Rock District could also be included in the scheme. The Lone Rock District was then dissolved and the boundaries of the United District extended. The Provincial Government in 1922 guaranteed the repayment of a \$550,000 debenture, issued with the lands of the District as security.

Construction of the works started immediately and was completed in 1924. The completed project with an irrigable area of over 30,000 acres cost about \$15 per irrigable acre.

When irrigation was commenced in 1924, the District, though fairly well settled, was twenty miles from the nearest railway station. Shortly afterwards the Canadian Pacific Railway Company constructed a branch line from Cardston through Hill Spring to Glenwoodville, hamlets within the Districts. This has resulted in increased population with a consequent increase in production.

The annual fixed charges against the District totalled about \$42,000 made up of \$30,000 debenture interest and \$12,000 operation and maintenance cost. Unfortunately, the farmers of the District have not had expert guidance in

irrigation and in the selection of crops which will provide the necessary revenue to meet its cost. Consequently operating deficits have occurred which have been paid by the Provincial Government.

In 1941, the Provincial Government in accordance with the recommendations of the Ewing Commission assumed all responsibility for the debentures. The farmers are only required to pay an average of about seven dollars per irrigable acre for the water right. This is less than half its actual cost, and it is believed that this amount can be paid and leave the farmer a reasonable income for himself.

A General History of Irrigation prepared by Mr. D. W. Hays is included as Appendix E.

ECONOMIC VALUE AND BENEFITS OF IRRIGATION TO EXISTING PROJECTS AND PROPOSED DEVELOPMENTS

The benefits which may be expected from the proposed St. Mary and Milk Rivers Development are indicated by the success which has been achieved by other irrigation districts in the Province, with comparable soil and climatic conditions. The Committee inspected the projects nearest to the proposed development when the crops were being harvested and interviewed the farmers, local business men, and other interested parties. The Committee also received representations from numerous organizations and individuals interested in the development of the St. Mary and Milk Rivers Project.

PROPOSED DEVELOPMENT STRONGLY SUPPORTED

All the representations submitted to the Committee emphasized the value and importance of irrigation to southern Alberta. Without exception, the proposed irrigation extension, which has been widely publicized by the Alberta Water Conservation Council, was strongly endorsed. Even the wheat growers, particularly those in the eastern section of the proposed area, who operate extensive holdings of low-priced but fertile land, admitted that these areas should be supporting a much larger population, but the strongest and most urgent appeal for the extension of irrigation was made by the farmers operating smaller units who have continued in business during the dry years in anticipation of obtaining water for irrigation.

IMPORTANCE OF IRRIGATION TO SOUTHERN ALBERTA

The primary purpose in providing irrigation is to increase production and to eliminate the hazards of crop failure from droughts. Irrigation affords a degree of stability in production which gives it a decided advantage over dry farming. The Committee found this advantage fully demonstrated in the much greater density of population adequately supported on irrigated land as compared to dry land and by the thriving agricultural communities and prosperous urban centres which were visited in the irrigation sections.

Possibly the clearest concept of the total benefits from irrigation in southern Alberta is obtained by considering what this area would be like with all irrigation eliminated. The following comparisons of population, property values, and land assessments in dry and irrigated areas, indicate the advantages of irrigation.

COMPARATIVE DENSITY OF POPULATION ON IRRIGATED AND NON-IRRIGATED AREAS

The major benefit of irrigation is the higher standard of living provided for a larger number of persons per unit of area on irrigated than on non-irrigated lands. The following statement provides a comparison of the density of population under the two systems:—

	(i) Number of persons per square mile according to the Quinquennial Census:			
	1921	1926	1931	1936
(ii) Wholly dry farming or grazing municipalities—				
(a) Bow Island-Burdett area.....	4.99	3.16	3.48	3.59
(b) Warner-Milk River area.....	2.28	2.26	2.95	3.34
(iii) Partly irrigated municipalities.....	8.92	9.83	12.03	12.69
Corrected figures for irrigation districts.....	19.32	23.05	28.32	29.68

(i) Includes towns and villages but not the City of Lethbridge.

(ii) Municipal Districts and Irrigation Districts Nos. 5, 6, 35, 36, 64, 65, and 94.

(iii) Municipal Districts and Irrigation Districts Nos. 37, 38, 66, 67, and 97.

The corrected figures for irrigation districts were obtained by assuming that each of the 917 square miles outside of the irrigation districts in the partly irrigated municipalities would support an equal population to that found on each square mile in the wholly dry municipalities and the remainder of the population was credited to the 500 square miles included within the boundaries of the five irrigation districts (Raymond, Magrath, Taber, Alberta Railway and Irrigation, and Lethbridge Northern) in the municipal units where about 72 per cent of the lands are irrigable.

During the period 1921 to 1936 it will be noted that the number of persons per square mile in the wholly dry farming areas varied from 4.99 persons in 1921 to 3.59 in 1936 in the Bow Island-Burdett area and from 2.28 to 3.34 persons in the Milk River-Warner area, while the population in the irrigation districts increased from 19.32 persons per square mile in 1921 to 29.68 persons in 1936, and the population per square mile in the five irrigated districts was 8.6 times the population in the non-irrigated area.

The density of population of an irrigation district is greatly influenced by the available markets for specialized crops, and by the degree of intensified farming developed. For the present and possibly for some time to come, it is evident that any great increase in the number of irrigation farmers must be through the extension of existing projects or by construction of works for irrigating additional areas. However, the possibility of increasing the population density in existing projects should not be overlooked. In this connection, the population records of the Taber Irrigation District give some indication of the extent to which population may be increased and supported where markets are available and farming is sufficiently intensified. Mr. Sundal, Secretary-Treasurer of the Taber Irrigation District, reports that, "at the time of organizing the project in 1921, the average size dry farm unit was about 320 acres. At that time farming was handled with horse equipment while today tractor units have extended the farm holdings to an average of two and three sections". Mr. Sundal states further that, "irrigation developments have reduced the irrigable unit to 85 acres and, including the dry areas on each farm, the unit is 138 acres. On the unit the farmer's family will average about 5 and with sugar beet development there is an additional family of about 3, making a total of 8 on the 85 acres, or approximately one person for each 10 acres. In addition, the urban population of Taber and Barnwell will add another 6 to the unit, making a total of 14 who directly and indirectly make their living from 85 acres".

By disregarding the practically non-productive dry or non-irrigable land in the Taber District, these figures indicate a population of 106 persons to the square mile, and even on the basis of the average farm unit of 138 acres, including 53 acres or over 38 per cent of dry land, the population density averages more than 66 persons to the square mile or nearly twenty times the population density of the dry land areas.

COMPARISON OF PROPERTY VALUES ON DRY AND IRRIGATED LANDS

The census for the year 1936 reports the average value of land in the non-irrigated municipal districts of Fortymile, Eureka, and Bow Island, all east of Taber, as \$11.38 per acre, and of similar land in the Milk River and Warner Districts as \$12.75 per acre. In comparison, in the partly irrigated municipal districts of Raymond, Coaldale and Taber the average land values are \$28.97, \$34.92, and \$17.84 per acre.

Assuming that the value of the dry lands within partly irrigated municipal units would average the same as in adjacent dry areas and crediting the remainder to the irrigated land, the estimated values of the irrigated lands at Taber, Coaldale, and Raymond would average \$64.92, \$82.50, and \$160.63 an acre respectively as compared to values varying from \$11.35 to \$12.79 per acre for non-irrigable land.

COMPARISON OF VALUATION FOR MUNICIPAL ASSESSMENT OF FARMS AND PROPERTY IN THE PROPOSED ST. MARY AND MILK RIVERS DEVELOPMENT AND IN EXISTING PROJECTS

The valuations of farms and property in the Municipal Districts comprising the proposed development averaged, in 1940, \$4.10 per acre in Bow Island, Eureka, and Fortymile and \$6.92 per acre in the Milk River-Warner area. The total valuations, the valuations per square mile and valuation per acre are tabulated below for the various districts. Similar information is shown for the districts, partly irrigated, at Coaldale and Taber.

Municipal District	Valuation for Municipal Assessment		
	Total	Per Square Mile	Per Acre
	\$ cts.	\$ cts.	\$ cts.
<i>Dry Land Group 1—</i>			
Bow Island No. 94.....	630,695 00	3,047 86	4 76
Eureka No. 65.....	965,481 00	2,371 89	3 71
Fortymile No. 64.....	846,765 00	2,658 60	4 15
(932 square miles).....	2,442,941 00	2,621 17	4 10
<i>Dry Land Group 2—</i>			
No. 5 Milk River E.....	1,492,500 00	4,606 48	7 20
No. 6 Milk River W.....	933,000 00	2,893 65	4 52
No. 35 Skiff.....	1,105,000 00	3,410 49	5 33
No. 36 Warner.....	2,780,113 00	6,125 62	9 57
(1,425 square miles).....	6,310,613 00	4,428 50	6 92
<i>Partly Irrigated Areas—</i>			
No. 66 Taber.....	1,940,000 00	6,978 41	10 90
No. 67 Coaldale.....	4,142,000 00	10,252 47	16 02

District No. 66, which includes the Taber Irrigation Project had, as shown above, an average valuation for municipal assessment of \$10.90 per acre. All of the land in this District is not irrigated and if the value of this non-irrigated

land is assumed as \$4.10 per acre, the average value of the land in Dry Group No. 1 of the Table, then the average of the irrigated lands should be \$58 per acre. Assuming a valuation of \$5.23 per acre for the non-irrigated portion of the Alberta Railway and Irrigation Project at Coaldale, the lands irrigated should have an average value of more than \$38 per acre.

TOTAL PRODUCTION FROM EXISTING IRRIGATION PROJECTS

Only limited information regarding the total value of production of the various irrigation projects in Alberta is available because general crop surveys were discontinued about ten years ago but the Economics Division of the Federal Department of Agriculture estimates that the gross value of production during 1940, including revenue from live stock, of all such projects in the Province totalled \$12,000,000 or an average of more than \$24 per irrigated acre. The total gross value of production in 1924 was \$7,007,536, \$10,581,763 in 1925, and \$9,018,940 in 1926, not including revenue from live stock.

In considering comparative figures of population, property values and gross production it must be realized that the most important factor is net revenue per person not production per acre. However, the comparative differences in the production from irrigated and from dry land indicated by the above statistics support the Committee's observations and the representations made to it.

INDUSTRIAL DEVELOPMENTS

The industrial development resulting from irrigation is contributing very substantially to the general welfare of southern Alberta and to the country as a whole. Two sugar factories for processing sugar beets, and two factories for the canning of a wide assortment of products from irrigated lands, and, in addition, seed cleaning plants, alfalfa meal mills, commercial apiaries, and other enterprises attendant directly or indirectly on irrigation and increased trade have been established in the area.

Were it not for irrigation the City of Lethbridge would depend entirely on coal mining, ranching, and wheat growing for its trade, and would not have achieved, as reported, the distinction of having the highest retail trade per capita in Canada during one or more of the depression years when relief in various forms was being distributed in large sections of the Prairie Provinces.

COMMUNITY DEVELOPMENT

The social and community advantages resulting from irrigation deserve special emphasis though these benefits can only be partly indicated statistically. These advantages were observed by the Committee on all projects visited and a good example is found in the Lethbridge Northern Irrigation District. Here an area of some 360 square miles, equivalent to ten townships, has been transformed in less than two decades from sparsely settled prairie subject to periodical crop failures and soil drifting to a thriving community of farm homes, towns, and villages. During this period the number of farm holdings increased from 300 to over 900 and the population, rural and urban, increased from 1,500 to 10,000. As a result educational facilities have been greatly improved by the establishment of modern consolidated schools; electrical power has become available; a gravelled highway has been constructed through the project; a branch railway line constructed since the District was erected provides shipping facilities; and a park established in connection with a storage reservoir on the project provides recreational facilities for the surrounding area.

FINANCIAL DIFFICULTIES IN CONNECTION WITH IRRIGATION

While the value of irrigation in southern Alberta is demonstrated in many ways in the projects now operating, frequent financial difficulties have had to be overcome by the Districts and individual farmers. The Committee therefore sought to determine as far as possible the main causes of the difficulties encountered in order that irrigation in all its aspects might be evaluated and considered in relation to the proposed extensions.

METHODS OF FINANCING

In the financing of projects constructed under the Irrigation Districts Act capital was obtained from the sale of bonds issued with the irrigable lands as security. In most cases the bonds were guaranteed by the Alberta Government. The Lethbridge Northern, United, and New West Districts were financed in this manner. Projects developed by railway and other companies which included the Alberta Railway and Irrigation Project; the Western and Eastern Sections of the Canadian Pacific Railway Project (the Eastern Section is now owned and operated by the Eastern Irrigation District); and the Canada Land and Irrigation Project at Vauxhall, were financed by the respective companies. Since 1935 a few small projects were financed without bonded indebtedness by the resident farmers but the cost of these projects was provided fully or in part under the provisions of the Prairie Farm Rehabilitation Act.

In the case of all of the projects constructed prior to 1935, the cost of construction was made a charge against the irrigable lands and varied from about \$1 per acre to \$3.50 per acre in addition to the yearly maintenance and operation costs of from \$1 to \$1.75 per acre, making a total annual cost of from \$2 to \$5.25 per acre.

No serious difficulties were encountered where the lower rates prevailed, but the higher rates frequently proved too great for the farmer to pay and consequently adjustments involving drastic reductions in capital charges were made.

MAIN CAUSES OF FINANCIAL DIFFICULTIES

The financial difficulties experienced in connection with irrigation farming in Alberta have, apparently, been due to five main causes:—

- (1) general economic conditions;
- (2) limited markets for crops successfully grown under irrigation in Alberta;
- (3) inefficient equipment available for grading land for irrigation;
- (4) inexperience in irrigation farming and management; and
- (5) the charging of the total cost of irrigation against the lands irrigated.

ECONOMIC CONDITIONS

The financial difficulties of the irrigation farmer have been due in large measure to the general economic conditions that have affected all phases of agriculture. During the first quarter of the present century many millions of dollars were expended by companies and by irrigation districts on the construction of works for the purpose of irrigating more than a million acres of land in southern Alberta. This period of construction and over-development coincided with the period of great industrial development, agricultural expansion and high prices during the World War and culminating in the boom of 1920. The cost of these projects was excessive because of the high price levels of this period, whereas the debt paying power of the farmer during the subsequent period was greatly reduced by declining prices. Agriculture generally suffered reverses during this period of low prices, consequently debt adjustments and reductions were necessary. The financial difficulties of irrigation projects were greatly

aggravated by the heavy burden of capital costs that had been assumed when prices were higher and by the assumption that the owner of irrigated land should pay the entire cost of irrigation. Moreover, the delay in settlement after the first Great War and the many years required to adjust financial policies to meet new conditions added to the difficulties.

TOO MUCH WHEAT

Farmers cultivating irrigated land have been growing too large a proportion of wheat rather than more specialized and less competitive crops. Wheat is essentially a dry land crop but, nevertheless, possesses advantages as a cash crop during irrigation development. Many of the farmers commencing irrigation were accustomed to growing wheat, and the necessary equipment and seed were readily available. On newly irrigated land where the surface was too uneven for uniform distribution of water, wheat suffers less than other crops. Also, wheat until recently was readily sold. It was only natural therefore that a large proportion of irrigated land on the larger projects should be devoted to this crop particularly during the early periods of development. Many of the farmers on irrigated land have, however, depended too much on wheat as a main crop. On some projects two-thirds of the total irrigated acreage has been seeded to wheat. Summer-fallowing of irrigated lands is not economic and with such a large acreage devoted to continuous wheat production weed infestation becomes serious. When wheat is grown in rotation with soil improving crops, such as alfalfa, yields of 40 to 50 bushels per acre have been obtained. When wheat has been grown as a single crop, the yields on most projects have been less than 20 bushels per acre.

An important advantage enjoyed by the irrigation farmer is that with water always available, a much wider assortment of crops may be successfully grown and the reduction in wheat acreage, necessitated by market conditions, is no problem for farmers on irrigated land because mixed farming provides better financial returns. More coarse grains and specialty crops are being produced in place of wheat, and the increase in live stock, and winter feeding, is providing a profitable use for the alfalfa hay and other forage crops grown on irrigated land.

PREPARATION OF LAND FOR IRRIGATION

A factor that has contributed in considerable measure to the difficulties of the irrigation farmer during development has been the problem of preparing the land for irrigation.

A general feature of the projects visited by the Committee was the favourable topography resulting in large areas of gently sloping land permitting easy and even distribution of water. Nevertheless considerable land preparation is necessary even in the most favourable areas, to facilitate the even spreading of water to ensure the high degree of production essential to meet the cost of irrigation and to provide a livelihood from the smaller area cultivated.

Under the policy followed in the past, the irrigation farmer was not only saddled with the burden of capital cost for the irrigation works but in addition undertook, with whatever means he had, the task of preparing the land for irrigation. With the inadequate horsedrawn equipment available, this work was costly and as a consequence, much of the land under irrigation was farmed for years before being properly prepared. However, with the efficient equipment now available it is possible to prepare land for irrigation at greatly reduced cost and with much saving of time. The mechanization of land preparation is, in fact, to be regarded as a major development in irrigation practice in the last few years and the extensive use of the various types of equipment now available including power scrapers and automatic levellers is obviating one of the main obstacles to success in irrigation farming.

With the horsedrawn equipment formerly used the cost of land preparation was not only excessive but slow, frequently extending over several years, whereas with present day equipment an entire farm can be better prepared for irrigation in a few days, at a cost of \$100 to \$300 for a quarter-section.

If land is not adequately prepared for irrigation, production is usually small but the increase in the first year's crop from properly prepared land may compensate for the whole cost of preparation. Experience indicates the importance of preparing the largest possible area of each farm for irrigation before settlement, thereby ensuring adequate returns to pay the cost of irrigation and to provide for the establishment of the settlers.

In general the necessary grading equipment must be provided by community organization or through governmental assistance as the cost of such equipment is too great to be a charge against each individual farm.

INEXPERIENCE OF EARLY IRRIGATORS

A factor which no doubt contributed in considerable measure to the difficulties and failures of the early projects was the inexperience of the operators in irrigation practices and management under Alberta conditions. Moreover, wheat growing dominated agriculture on the prairies and the average irrigation farmer thought in terms of wheat and extensive operations rather than in the intensive farming essential for success under irrigation. However, much knowledge and experience has been gained over the years by irrigation farmers and agriculturists whereby systems of farming adapted to irrigation have been developed as distinct to dry farming or wheat growing. What is equally significant from the standpoint of irrigation development and possible expansion is that a large section of the population of southern Alberta both rural and urban realize the advantages of irrigation. This general support and belief in irrigation, and the large amount of experience gained by successful irrigators, are contributing largely to the success of irrigation in southern Alberta and this public support and store of experience will be equally valuable when any further developments are undertaken. With this background of experience, a recurrence of wet years is not likely to mislead public opinion to temporarily forget the need of irrigation and to neglect the maintenance of the irrigation works.

FAILURE OF POLICY OF CHARGING ENTIRE CAPITAL COST OF CONSTRUCTION TO LANDS MADE IRRIGABLE

The irrigation farmers' main financial difficulty is attributed to the policy of charging the entire capital cost of the irrigation works directly against the lands made irrigable. This policy has failed because the prices of agricultural products have been too low to permit of the payment of the entire fixed charges.

The policy has been successful when the capital charges and the rates are capable of being paid by the water user from the increase in revenue due to irrigation. An example is the Taber Irrigation Project where the capital cost charged to the lands amounted to \$16 per acre and the annual irrigation rates, including capital and maintenance, from 1920 to 1940 varied from \$1.50 to \$2.60 and averaged less than \$2 for the period. In contrast on the Lethbridge Northern Irrigation Project, the capital cost of irrigation, not including the cost of the land, amounted to \$55 per acre and the rates assessed against the land for irrigation were too high for profitable operation.

At first an attempt was made to correct the difficulty by deferring the payments on the Lethbridge Northern Project and establishing a schedule of payments which provided lower instalments during the early years but without any reduction of the total debt. The relief so provided was only temporary as the deferred payments of principal or interest accumulated.

A revision of the capital structure was later arranged with the Provincial Government as guarantor relieving the Irrigation District of responsibility for repaying the greater portion of its bonded indebtedness. For historical reasons it would seem advisable to discuss in some detail the schedule of payments designed to relieve conditions during the early years.

The schedule adopted in 1925 on the recommendation of Dr. John A. Widstoe, provided that no payments would be required during the first three years of occupancy. Annual payments at the rate of \$2 per acre were to be made for the fourth, fifth and sixth years of occupancy, \$3 per acre for the seventh to tenth year, and \$4 per acre for the eleventh year to fifteenth year, and \$5 per acre for the sixteenth and subsequent years with the extinguishment of the debt at the end of the forty-ninth year. As no water right payments were required during the first three years, the contract extended over fifty-two years. During this period the water user would have paid under this schedule \$208 per acre or a total of \$33,280 for the water right to irrigate a quarter-section of land, and the service charges, on the basis of \$1.25 per acre, would have added another \$200 per year or a total of \$43,680 during the fifty-two year period, an average of \$840 a year for an irrigated quarter-section. This would not have included the cost of the land or municipal taxes.

The main object in extending payments over a long period was of course to reduce the annual payments, which is all-important so far as the individual farmer is concerned. However, despite the long period of payment the rates, except for the early years, were high for the average farmer and certainly too high for conditions that have prevailed during most of the years since the project was established. What was equally serious was the fact that payments would extend over more than two generations, so that a farmer assumed the obligation for a water right with little or no hope of completing the contract within his lifetime.

FINANCIAL RETURNS FROM DIFFERENT TYPES OF IRRIGATION

As well as considering the cost of construction to provide irrigation to the proposed extension, the increase in production resulting from irrigation must also be considered. It must be recognized that the economic returns from irrigation and the density of population that may be satisfactorily maintained are determined primarily by the market value of the crops and live stock produced and the production of commodities that have market value must therefore be regarded as a major factor in any irrigation expansion.

In the Lethbridge area where nearly a quarter of a million acres are irrigated local processing plants provide a ready market for sugar beets and canning crops, the main production of the district. In the Eastern and Vauxhall Projects live stock and live stock feeding provide profitable use for the crops produced.

Some indication of the relative economic value of the various crops and types of farming under irrigation is given in the results of surveys conducted by the Economics Division of the Federal Department of Agriculture. These include (1) wheat growing (2) sugar beet production and (3) live stock and live stock feeding.

WHEAT GROWING

As already indicated, many of the financial difficulties in connection with irrigation have been attributed to the growing of wheat to the exclusion of diversified crops. This theory is strengthened by the results of the survey in the Vauxhall area for the year ended June, 1940, when 31 quarter-sections producing wheat showed average labour earnings of \$303, while the change in net-worth for the year showed losses averaging \$121 per farm. A limited

amount of wheat may be grown to advantage when rotated with soil improvement crops but the farmer on irrigated land cannot grow wheat as a main crop in competition with the dry land farmer, and, it is apparent that wheat growing offers no opportunity for expansion of irrigation.

SUGAR BEET GROWING

The highest degree of agricultural development on irrigated lands in Alberta is found in the areas where sugar beets are grown for sale to the sugar factories at Raymond, south of Lethbridge, and at Picture Butte in the Lethbridge Northern Irrigation District.

With irrigation to provide moisture as needed, the soil and climate of southern Alberta are favourable for sugar beet production. Improved cultural methods and fertilization have nearly doubled the average yield while Alberta beets generally show a higher sugar content than beets grown elsewhere on the continent—more than 17 per cent. This high content is attributed to long days of sunshine and relatively cool nights which favour the production and accumulation of sugar in the plant. Early frosts are a hazard of sugar beet growing on the Prairies, but within the Chinook Belt the danger is not great.

Some indication of the great economic value of the sugar industry is given by the gross returns to the beet grower which averaged \$98.70 per acre for the 1940 crop, the average yield being 14.10 tons per acre and the price \$7 per ton. During that year, approximately \$2,394,000 was paid to the beet growers. In addition the sugar company paid, in connection with the 1940 crop, a total of \$320,000 for freight, \$494,000 for materials, and \$512,000 for salaries and wages, making a total of over \$3,720,000 that was put into the channels of trade from this industry in one year.

An economic survey of sugar beet farming in the Taber District during the year ended June 30, 1940, showed average labour earnings of \$1,188 per quarter-section with an average gain in net-worth of \$527 for each farm during the year after providing for all operating charges including interest on investment, depreciation on equipment, and water rentals.

The sugar beet is highly rated as a soil improver and as a weed-destroying crop and the by-products beet tops, pulp, and molasses provide excellent stock food. During 1940 about 18,000 range cattle and 76,000 sheep brought from southern Alberta and southwestern Saskatchewan were placed in feed lots within the areas adjacent to the sugar factories at Raymond and Picture Butte.

Assuming a sugar consumption of 93 pounds per person per year, the production in 1940 from the two factories operating in Alberta, 93,466,400 pounds, was nearly 58 per cent of the sugar consumption of the two Provinces of Alberta and Saskatchewan. As the sugar requirements of Manitoba and British Columbia are mainly supplied from factories within those provinces the market for Alberta sugar is restricted to Alberta and Saskatchewan. However, in view of the value of beet growing to agriculture and the desirability of producing, so far as possible, the necessities of life within Canada, the expansion of beet sugar production deserves careful consideration. As Canada produces less than 20 per cent of its total sugar requirements, there is the possibility of beet sugar production assuming increased importance as a result of unforeseen contingencies.

SPECIALTY CROPS

The widest assortment of crops grown on the Prairies is found in the irrigated districts, where the influence of the Chinook wind is indicated by higher temperatures and longer growing seasons. Many of these crops, particularly vegetables and small fruits, have been grown mostly for home use rather than for sale. In recent years, however, markets have been created for these crops

and while the acreage devoted to such crops is still limited, the per acre returns are relatively high and the various processing plants, for canning and seed cleaning, provide considerable local employment.

A modern canning factory was established at Taber in 1934 and a second and larger unit was constructed in Lethbridge in 1941. Each year approximately 2,000 acres of corn, string beans, peas, beets, carrots, and pumpkins are grown for the Taber factory. The value of these crops is indicated by the following per acre returns for 1940:—

	Average yield per acre— in tons	Average acre income
Corn	3.0	\$ 27
Peas	1.5	40.
String beans	2.67	116
Beets	2.2	32
Carrots	1.98	28
Pumpkins	17.43	90

POTATOES

Potatoes grown on irrigated land in Alberta have a reputation for high quality and this crop provides a substantial source of income on many irrigated farms. In one of the districts visited by the Committee, handling facilities for the year's potato crop were being provided at the local shipping point where potatoes were to be graded and stored until required for shipping. These growers are producing a high-grade product that commands a premium on the market.

CANNING PEA SEED

The relatively dry atmospheric conditions that prevail throughout the irrigated sections of Alberta are favourable to the production of high quality seed and most seed of garden and canning peas sold in Canada is grown in this area. Increasing quantities of seed of canning and other varieties of peas, grown on irrigated lands in the province, are being sent to Great Britain for growing food under war-time conditions.

MISCELLANEOUS SEED CROPS

Other seed crops grown on irrigated lands include alfalfa, several varieties of beans, fibre flax, and several varieties of grass seed.

DAIRYING

Dairying provides another profitable alternative to wheat growing on irrigated lands. The growing of alfalfa and pasture crops under irrigation provides abundant supplies of high quality food for dairy cattle and this should conduce to the development of an extensive butter, cheese and condensed milk industry. Cheese factories are now operating in the Eastern, United, and Mountain View Irrigation Districts, and in the Alberta Railway and Irrigation Project.

LIVE STOCK AND LIVE STOCK FEEDING

The irrigated farm, with feed and water available in abundance, offers important advantages for the winter feeding and fattening of live stock. The exclusive growing of wheat or any other single crop on irrigated land is neither sound agriculture nor economics, whereas a system of irrigation farming based mainly on feed production and live stock feeding offers, according to evidence submitted to the Committee by successful irrigation farmers, stability and security.

A survey of typical live stock farms in the Bow Slope area of the Eastern Irrigation District for the year ended May 31, 1941, shows average labour earnings of \$388 for the quarter-section farms surveyed. An average of 54 per cent of the total income on these farms was derived from live stock, including hogs, cattle, and sheep, as compared to 43 per cent from crops. The change in net-worth for the year averaged a gain of \$50 for each of the 26 quarter-sections studied. During the same period stock-feeding farms in the same project had average labour earnings of \$415 with average gain in net-worth of \$56 for quarter-section farms. On farms larger than 800 acres average labour earnings were \$1,711 and gains in net-worth were \$1,416.

The labour returns for the small-sized farms were not high. The farms, nevertheless, showed some profit after providing for all charges including interest on investment, depreciation on equipment, and water rentals. Gains in net-worth were also shown.

SUMMARY OF RESULTS FROM VARIOUS TYPES OF FARMING UNDER IRRIGATION

Information submitted to the Committee showed that the highest returns per acre from farming on irrigated land are obtained from sugar beet production. Soil and climatic conditions in southern Alberta are highly favourable for the growing of sugar beets on irrigated land. Expansion of the sugar beet industry has in the past been restricted because of market conditions. Conditions during or following the war may make it desirable and perhaps necessary to enlarge this industry in Canada.

The returns from wheat grown on the irrigated farms surveyed were less than the total cost of production and, except for limited acreage, wheat is not a profitable irrigated crop. On the other hand, profitable returns were obtained, according to information submitted, from live stock, stock feeding, and various specialized crops. It would appear therefore, that live stock production, including dairying, and the growing of various specialty crops offer the best prospects for success on irrigated lands.

AMOUNT OF CONSTRUCTION COST THAT COULD BE RECOVERED FROM THE FARMER

The successful operation of any irrigation project requires that the amount charged to the farmer should be within his capacity to pay. It is emphasized by Professor A. Stewart, Department of Political Economy, University of Alberta, Edmonton, that it is extremely difficult to anticipate the amount which the farmer can be expected to pay. Even the most moderate estimate may be upset by changed market conditions. Professor Stewart also emphasizes that any reasoned estimate of the farmer's capacity to pay must be based on (1) the size of farm, (2) the type of farming, (3) the ability of the farmer, and (4) the amount which the farmer may require for his own use.

THE SIZE OF FARM

There is a relationship between the size of farm and the income which can be secured by the farm operator. The best size of farm depends on many factors, including the type of farming and the ability of the farmer. In attempting to arrive at an estimate it would seem best to assume farms of average size for the type of farming being considered. In the case of the farming of irrigated land this would generally be the quarter-section; although some differences might occur due to the crop grown.

THE TYPE OF FARMING

Surveys conducted by the Economics Division of the Federal Department of Agriculture show that the largest returns from irrigated lands are being made from beet growing; that reasonably satisfactory returns are being secured from

live stock production, including dairying, and that returns from grain growing are relatively poor. Increased beet production is uncertain and wheat growing on irrigated land cannot compete with cheaper dry land production. The types of farming which offers immediate prospects for expansion are live stock, including dairying, and the production of specialty crops adaptable to intensive methods of irrigation farming.

THE ABILITY OF THE FARMER

Success in irrigation, as in other kinds of farming, requires ability and irrigation farming offers no opportunities for the incompetent. It is essential, therefore, in the establishment and operation of any project that there should be, first, careful selection of farmers; second, provision for the removal of farmers who prove incapable of adapting themselves to irrigation practices; and third, provision of field services to keep farmers informed as to the best methods to follow to ensure the greatest possible degree of success.

THE AMOUNT WHICH THE FARMER SHOULD HAVE TO MEET THE LIVING EXPENSES OF HIS FAMILY

The opportunities of home building and security from the hazards of crop failure due to drought are the main advantages of irrigation. Financial returns, for the most part, accrue only in a limited measure to the irrigation farmer. Nevertheless, it must be emphasized that for the successful operation of any project the returns to the farmers must be comparable to the returns that may be secured elsewhere, having regard to the added value of irrigation for better living conditions.

ANNUAL PAYMENTS ON EXISTING PROJECTS

The cost per acre varies greatly on the different irrigation projects. The total capital charges due to irrigation have varied from a few dollars per acre in the case of the Mountain View Project to \$55 per acre in the Lethbridge Northern. The annual charges, including capital costs, maintenance and operation varied correspondingly, from less than 30 cents per acre to more than \$5.25 per acre.

Some of the higher rates were later reduced and the following are summaries of annual charges made in the different irrigation districts in Alberta. These summaries are based on information supplied by the Alberta Water Resources Office and the Economics Division of the Federal Department of Agriculture.

TABER IRRIGATION DISTRICT

Most of the farmers owned their land when this district was erected. The water payment is collected in cash and includes a payment to cover retirement of the District's bonded indebtedness which amounts to \$16 per acre. The total annual payments have varied from \$1.50 to \$2.60 and averaged slightly less than \$2.00 per acre. Following are the details for the 1940 assessment:—

Principal	\$0 64
Interest on bonds	0 44
Maintenance	0 42
Water rental to the C.P.R.....	0 50
	<hr/>
	\$2 00

LETHBRIDGE NORTHERN IRRIGATION DISTRICT

The service charge in this district is collected either in cash or is a first charge against the crop share in the case of crop share contracts. The water right or charge for construction is included in the land contract. The price of

the water right varies according to the classification of the land and averages about \$17 per acre. Most of the farmers assign one-tenth of their beet crop and one-fifth of all other crops to apply to the service charge and water right payments. Land owned by the Provincial Government is rented on a crop share basis until an agreement of sale or a contract is issued.

Following are the total annual charges per acre for the four-year period 1937-1940:—

	1937	1938	1939	1940
	\$ cts.	\$ cts.	\$ cts.	\$ cts.
Rates and Rent.....	1 50	1 53	1 34	1 22
Payments on Contracts.....	0 83	1 06	1 12	1 12
Total.....	2 33	2 59	2 46	2 34

EASTERN IRRIGATION DISTRICT

A large portion of the irrigable land of this project was held by farmers under agreements to purchase at prices ranging from \$25 to \$50 per acre, when the project was transferred to the farmers by the Canadian Pacific Railway Company. Subsequent to this transfer all contracts were adjusted and reduced to approximately one-fifth of the original amounts. The price of the best irrigated land was reduced to \$10 per acre.

The service charge levied for maintenance was \$1.75 per acre in 1935, 1936, 1937, and 1938. In 1939 and 1940 the charge was \$1.60 and in 1941 the charge was increased to \$1.70 per acre.

CANADA LAND AND IRRIGATION PROJECT

This Company generally sells its land on a quarter-crop share basis. The service charge is a first charge against the crop share; any credit remaining after the service charge is paid is applied first to interest and then to principal. The price of the irrigated land varies according to the classification of the land and averages about \$21 per acre.

The service charge for maintenance and operation is \$1.50 per acre annually.

WESTERN SECTION, CANADIAN PACIFIC RAILWAY

When this project was constructed the Company owned practically all of the land in the district. Irrigable land was sold in most cases at \$10 per acre higher than non-irrigable land, which is the equivalent of \$10 per acre for the water right. The service charge is 50 cents an acre annually and is usually collected in cash.

LETHBRIDGE SECTION, CANADIAN PACIFIC RAILWAY

Land in this project is now usually sold on a crop share basis of one-fifth of the beet crop and one-third of other crops. The service charge, amounting to \$1 per acre, is a first charge against the crop share and is charged by the Company which only operates the main canal and the larger branch canals. The farmers operate their own distribution works, individually or co-operatively, at a cost of about 25 cents per acre.

THE UNITED IRRIGATION DISTRICT

Prior to 1941 land in the United Irrigation District was being sold separately from the water right on a crop-share basis of one-sixth of each year's crop until the purchase was completed. For the irrigation of these lands there was an annual cash charge of \$1.40 per acre. This was composed of 90 cents for water right and 50 cents for service charge.

In 1941 the Alberta Government applied the general principles of the Ewing Commission's Report to this project and assumed part of the cost of construction of the irrigation works. The original charge against the land for the irrigation works was reduced from \$15 per acre to \$7 per acre, payment to be made in annual instalments.

MOUNTAIN VIEW IRRIGATION DISTRICT

The works of Mountain View Irrigation District are relatively inexpensive and easy to maintain. There is no bonded indebtedness and the annual charges for maintenance and operation have varied from 20 to 30 cents per acre.

MAGRATH IRRIGATION DISTRICT

The Magrath Irrigation District levies a charge of \$2.50 per acre annually. About half of this is required for service charges and the balance is applied to water right payments.

RAYMOND IRRIGATION DISTRICT

The Raymond Irrigation District levied a charge of \$1.50 per acre in 1941 to cover all charges for that year. About 45 cents is required for service charges and the balance is charged to water right payments.

FINDINGS OF EWING COMMISSION

The Ewing Commission was appointed in 1936 to determine the value of irrigated land on a number of irrigation projects in Alberta. On the evidence obtained, the Commission recommended a scale of values for irrigated land as defined by the Wilson Commission. The combined values tabulated below include the value of the land itself, plus the value of the water. The land ratings were based on soil, topography, and proximity to market and the ratios of the value for land and water were varied according to precipitation and the value of irrigation.

COMBINED LAND AND WATER VALUES RECOMMENDED BY THE EWING COMMISSION

Land Ratings	Total Value per Acre
60 per cent	\$17 14
70 per cent	20 00
80 per cent	22 86
100 per cent	28 57

In the areas of lighter rainfall such as the eastern part of the Lethbridge Northern Irrigation District, water was valued at six-sevenths of the total combined value of land and water. In the western areas where rainfall is somewhat heavier, land was valued at three-sevenths and water four-sevenths of the total combined value.

The Report of the Ewing Commission recommended a reduction in the price of land with water to that which any farmer of average industry and skill could pay over a period of years. "It follows," the Report adds, "that the burden of such reduction must be borne by the province as a whole, but this reduction is predicated on the assumption that the plan, if adopted, will be rigidly carried out, so that no further loss or expense may be incurred by those who are not primarily liable for any of the indebtedness. The Commission has been made fully aware that irrigation authorities now agree that the full capital cost of any irrigation project should not be charged up to the lands immediately benefited. The conversion of a non-productive arid area into lands intensively farmed benefits not only the irrigation farmer but also the community, the province and the Dominion as well as many private enterprises such as railways and factories."

The recommendations of the Ewing Commission were made following exhaustive inquiry and the hearing of the evidence of farmers established on the land and of recognized irrigation authorities. The records of various Irrigation Districts were also examined. These recommendations have been applied to two of the larger irrigation projects and have been implemented by provincial legislation as recently as 1938, thus settling controversies of long standing.

The determination of the amount which the farmer can be expected to pay is of the utmost importance; but this is the most difficult part of the problem. The Committee has gathered some information on this point but has not undertaken the extensive inquiry which would be necessary to arrive at an independent conclusion.

The primary purpose of the St. Mary and Milk Rivers Development would be to provide means for an extended colonization program. For this reason, and because of so many unknown and unpredictable factors affecting the agricultural industry and conditions generally that may prevail at the termination of the war, the Committee has not made any attempt to estimate what price per acre the farmer may be expected to pay for irrigated land in the proposed development.

The Committee is, however, much impressed with the general principle of land classification recommended by the Ewing Commission; and suggests that in the event of the project being undertaken that the lands be classified on a similar basis. The Committee further considers that before any settlement of land takes place that land values should be reviewed and appraised by competent authority on the basis of long-time yields and prices.

BASIS OF ANNUAL PAYMENTS

While the value of the land to the farmer or the amount which the farmer can pay for land is usually stated as a capital sum, it is the amount of the annual payment which is important.

The farmer's capacity to pay may vary widely from year to year as the result of variations in prices and variations in output, even though production is much more stabilized under irrigation than in dry land farming. If the contract calls for a fixed annual money payment the farmer in years of better-than-normal returns, is not required, and in most cases will not undertake, to pay more than the fixed annual amount. In years when either prices or output, or both, may be unfavourable, it may be practically impossible for him to make any payment on arrears or current charges. There is, therefore, a strong argument for the adoption of a type of contract which would vary the payment from year to year on the basis of some measure of the current capacity to pay. This is in part provided for by the crop-share agreement plan of repayment now in effect on many of the irrigation projects in Alberta.

If the farmer is purchasing under agreement of sale or acquires title to the land subject to a mortgage, the normal expectation would be that the farmer would be able to acquire clear title to his land by paying off the capital sum. It should be emphasized that this involves a process of saving on the part of the farmer; and the rate of saving expected should not exceed the farmer's capacity to save. The payments should not be extended beyond a reasonable period consistent with the opportunity under average economic conditions for the farmer to secure clear title to the land during his lifetime. On this basis it would appear that land payments should not extend over more than 20 or, at most, 25 years.

VALUE OF PROPOSED DEVELOPMENT AS POST-WAR UNDERTAKING

The termination of the war, it is to be expected, will present acute problems of establishing in peace-time industry demobilized soldiers, persons engaged in war industries, and possibly immigrants. The construction of the main works of the proposed St. Mary and Milk Rivers Development might be considered as a public works project to provide employment during the post-war period. An important advantage of the project in this connection would be its flexibility and the possibility of varying the construction program to meet existing conditions.

The first stage of construction which would provide for the full utilization of Canada's share of the St. Mary River could be extended over five years or could be completed within three years if necessary. The total expenditure for this first stage of development is estimated at slightly more than \$6,700,000 and would make water available for an area of more than 94,000 acres. It would also provide additional water necessary for areas served by the Alberta Railway and Irrigation Company's system. The remaining construction might be extended over ten years but could be completed in a much shorter period if deemed advisable. From the standpoint of a works program, therefore, and as a possible substitute for relief the proposed St. Mary and Milk Rivers Development possesses considerable merit.

The undertaking of so large a project during the war could hardly be recommended at the present time. However, as the proposed construction program is lengthy, it would seem desirable to take such steps as might facilitate its prosecution later without withdrawing labour and materials from urgent war effort. For example, if the project were approved for the post-war period it would seem advisable, in the meantime, to proceed with such preliminary work as detailed surveys, engineering design, and the securing of options on necessary lands, in order that construction may be started as soon as possible after the cessation of hostilities.

ANNUAL SAVING TO PUBLIC TREASURY BY REMOVAL OF FARMERS FROM SUBMARGINAL LANDS

The transfer of farm families from submarginal lands would result in a considerable annual saving to the public treasury in relief expenditure, an expenditure which to a large extent may be regarded as non-recoverable. In a summary of relief expenditures in Saskatchewan and Alberta, Appendix C, Mr. Mark Mann of the P.F.R.A. Branch of the Federal Department of Agriculture, shows the enormous expenditures for relief in the two provinces.

During the severe drought years from 1931 to 1938 the relief expenditures in Alberta amounted to \$51,968,585 including relief works, direct relief administration, and medical aid. The total relief expenditures in Saskatchewan amounted to \$134,230,046 during this seven-year period, making a total of \$186,198,631 for the two provinces.

Food, seed, feed, and fodder including freight were main items of expense. During the winter of 1937-38 some 488,000 tons of feed were supplied in the drought area of Saskatchewan and 44,000 tons in Alberta. Much greater quantities would have been required had not more than 474,000 cattle been removed from the drought area.

Very substantial assistance was given to farmers in the drought area through debt cancellations and adjustments. In Saskatchewan alone this amounted to about \$100,000,000.

More than \$12,000,000 has been expended under the Prairie Farm Rehabilitation Act since 1935 for water development, community pastures, cultural work, and soil drifting control work. The main purpose of this work is to assist farmers in the drought areas to rehabilitate themselves and become largely if not entirely self-sustaining during future years of low rainfall.

To supplement the benefits of the Prairie Farm Rehabilitation Act, the Prairie Farm Assistance Act was passed by the Federal Government in 1939 as a substitute for direct relief. This Act provides that when, because of adverse conditions the yield of wheat in any township averages less than 12 bushels per acre cash assistance may be given the farmers (See Appendix C). The total payments under this Act during the 1939-40 period, the first year of operation amounted to \$7,434,424 in Saskatchewan and \$1,600,934 in Alberta. The payments for the 1940-1941 period amounted to \$492,253 for Alberta and \$5,592,496 for Saskatchewan according to figures given by Mr. E. L. Gray, Director of the Prairie Farm Assistance Branch of the Federal Department of Agriculture. The figures for the 1941 crop were not available but Mr. Gray estimated that the 1941 crop will necessitate assistance in approximately 2,800 townships as compared with 1,648 in 1940 and 1,923 in 1939. Mr. Gray further stated that about 100 townships, because of average yields of 4 bushels per acre or less, received assistance for three successive years, consequently it is reasonable to suppose that these townships must contain a large proportion of marginal and submarginal land. In 26 of these townships each farmer received assistance averaging \$300 per year. This, in effect, represents the annual cost to the Government of maintaining a farmer on these submarginal lands without taking into account any additional payments under the Wheat Acreage Reduction Plan.

The proposed St. Mary and Milk Rivers Development would, when fully developed, provide irrigated land for some 2,800 farmers, and there are about 2,000 farmers in the 100 townships who have received P.F.R.A. assistance for three consecutive years. Assuming that 1,000 of these farmers could be settled on irrigated land and made self supporting the saving to the Government on the foregoing basis would amount to \$300,000 annually. Capitalized at 3 per cent this would represent a capital investment value of \$10,000,000. Moreover the benefits would not be limited to the 1,000 farmers placed on irrigated land as the farmers remaining could be placed on larger farms with live stock as an added source of income to utilize the land that would revert to grass.

Under the provisions of the P.F.A.A. assistance has been given in every township east of the Taber Irrigation Project and included in the proposed Development. In many of these townships assistance has been given in each of the three years since the passing of the Act.

OTHER NATIONAL BENEFITS

In addition to the value of the proposed project as a substitute for direct relief during the post-war adjustment period and the saving in relief and resources by the transfer of farmers from submarginal lands there are at least five more reasons why an irrigation development of this magnitude should be considered from a national viewpoint. These five reasons are: (1) the project

provides insurance against the loss of a valuable resource; (2) the effect on employment elsewhere; (3) benefit to the adjacent ranching industry; (4) benefit to transportation interests, and (5) the general social benefits from the establishment of a stable and contented community.

INSURANCE AGAINST LOSS OF NATIONAL RESOURCES

Direct national interest in this development results from the fact that the St. Mary and Milk Rivers, a most valuable source of water irrigation in Canada, are subject to division between Canada and the United States under Article VI of the Boundary Waters Treaty of 1909. The International Joint Commission set up under authority of the Treaty, by a final order in 1921, defined the division of the waters between the countries. At the same time a plan of storage for utilizing these waters in both countries was recommended. The United States has completed storage works making available for use more than its portion of the waters of the two rivers, but Canada so far has depended entirely on direct diversion. During the past 19 years Canada has made only a limited use of its share of the waters of the Milk River and has used an average of only 40·5 per cent of its share of the combined flow of the rivers. National interest therefore is largely involved.

Water used for irrigation possesses an important characteristic not common to most natural resources in that its use enhances the value of the land to which it is applied and this value increases with continued use as more intensive agriculture is developed. Owing to the time required to develop irrigation, governmental or other aid is necessary during the early years. Ultimately, however, the national benefits from any basically sound irrigation project far exceeds the original cost of the project.

EFFECT OF DEVELOPMENT ON EMPLOYMENT ELSEWHERE IN CANADA

In addition to providing direct employment during the period of post-war rehabilitation, the development and operation of the project would be an effective means of creating additional employment in other occupations and in other parts of the country. This indirect employment would be induced by the purchase of material for construction, by increased activity in industries processing farm products, industries producing goods consumed by the farmers and in the transportation systems. Owing to the more intensive agriculture that may be developed under irrigation and the greater density of population that may be supported there is reason to suppose that the development of irrigation would have an important effect in inducing employment in other parts of the national economy.

VALUE OF IRRIGATION TO RANCHING INDUSTRY

The contribution of irrigation development to the ranching industry is a further important benefit to the country at large and to the West particularly. The extensive grass lands of southern Alberta and southwestern Saskatchewan constitute a resource of great national value. Furthermore the full utilization of these grass lands is essential in establishing a balanced and fully self-supporting agriculture throughout the low rainfall area of the open plains.

However, the use of these range lands involves great hazards unless live-stock feeds are available from other sources to provide winter forage during periods of prolonged drought that occur at varying intervals throughout this area. The stability and security afforded by irrigation for the growing of winter feed during these periods is the first important benefit of an irrigation project to the surrounding live-stock industry. Irrigation not only provides

insurance against frequent losses through lack of sufficient feed, but also against the danger of total losses that have occurred periodically when long hard winters followed years of extreme drought and limited feed supplies.

The early ranchers were the first to use water for growing feed. The ranchers who developed and maintained adequate irrigation were able to maintain their stock during such hard winters as occurred in 1897-98; 1906-07; 1919-20 and 1936-37, when feed scarcities and low prices caused heavy losses.

During the acute drought of the past decade many ranchers, without Government aid, wintered thousands of cattle and sheep including breeding stock on the irrigation projects of southern Alberta. In Saskatchewan, because of the lack of irrigation, it was found necessary in 1937 to ship for feeding, with Government assistance, some 75,000 cattle as compared with about 15,000 shipped from Alberta. The cost of this operation to the Federal Government was \$340,000. A total of 474,000 cattle was shipped out of the drought area that year at a loss to the producers of millions of dollars.

The effect of this prolonged drought period on the number of cattle in Saskatchewan and Alberta is indicated in the following table for the years 1935 to 1941 inclusive(*):—

CATTLE POPULATION IN THOUSANDS

—	1935	1936	1937	1938	1939	1940	1941
Saskatchewan.....	1,486	1,535	1,441	1,129	1,170	1,249	1,350
Alberta.....	1,604	1,854	1,458	1,362	1,337	1,365	1,458
All of Canada.....	8,819	8,841	8,839	8,511	8,474	8,565	8,797

(*) From Records of Production Service, Dominion Department of Agriculture.

Live Stock Feeding.—Irrigation is equally valuable to the ranching and live stock industry under normal or abnormal weather conditions. An irrigated area provides ideal feeding grounds for range cattle and live stock fattening in the irrigated districts of southern Alberta has developed into a major industry. The value of animals fattened in feed lots during the season 1941-42 totalled about \$3,900,000.

In the area south of the Canadian Pacific Main Line in Alberta there were, in 1941, according to Mr. J. Byers, District Supervisor of the Dominion Production Service, approximately 250,000 cattle comprising the bulk of Alberta range cattle which make up 15 per cent of the total cattle population of the Province. About 80,000 cattle were shipped in 1941. At least 30,000 of this number were put in the feed lots and about 10,000 were put on cover crop pastures. Over 90 per cent of the grain fed cattle were placed in the feed lots on irrigated areas. During the same period 100,000 lambs from the ranges of southern Alberta and southwestern Saskatchewan were placed in the feed lots and fields of the irrigated districts.

These feeding operations, developed largely within the past 15 years, must obviously have a far-reaching effect on the agricultural economy of the area. These animals are providing an outlet for large quantities of coarse feed that would otherwise have little market value. In addition large quantities of grain are being utilized at or near the point of production. The cattle, for example will on the average consume nearly a ton of grain per head during the feeding period and it is especially important to observe that three-fifths of the grain fed is wheat. Sheep require a smaller percentage of grain but are capable of salvaging large quantities of roughage that grows on irrigated land.

The irrigation extensions proposed would provide for feeding and finishing a greater proportion of the live stock produced on the ranches of the West and in the community pastures established under the P.F.R.A. Branch, Federal Department of Agriculture. Irrigation extension would, also, provide added insurance against loss during periods of acute feed shortages and make it possible for the live stock producer to make the fullest possible use of the natural grass areas.

BENEFITS TO TRANSPORTATION INTERESTS

The advantage of the development of irrigation to railways and other transportation interests has long been recognized in the United States and Canada where transportation companies have, in some cases, financed the building of irrigation works and colonized the reclaimed areas to increase the flow of raw farm products and manufactured goods and thereby increase traffic revenues. In the case of the St. Mary and Milk Rivers Development, it is proposed to ultimately irrigate 345,000 acres of which a part is now being farmed under dry land conditions. It is hardly necessary to point out that the increased volume of production with irrigation would greatly increase traffic both with respect to the export of raw and finished products and to the manufactured goods shipped into the district.

The area is already well served by railroads whose freight carrying capacity could be largely increased with little additional capital investment. The benefits are difficult to evaluate but the foregoing is sufficient to indicate the extensive increase in revenue which may be expected by the transportation interests as a direct result of this irrigation development.

GENERAL SOCIAL BENEFITS OF IRRIGATION

The general social benefits from the establishment of a stable and contented community are of value to the nation as a whole. These benefits mainly accrue from the favourable conditions for living and for home-building that may be created by diligent effort under irrigation, as trees may be grown for shelter and foods of high quality may be grown in abundance for home consumption and for sale.

The greater population densities supported under irrigation promotes improved community life and better social services at less cost. The community, the province and the nation benefit from the improved standard of living maintained, where relief is mainly eliminated and where the essential qualities of good citizenship are engendered by the co-operation necessary to the successful operation and maintenance of an irrigation project.

DISTRIBUTION OF BENEFITS

It is recognized by irrigation authorities and has been proven by the results of completed irrigation projects that, in general, successful operation of large projects is impossible if the entire cost of construction is charged against the irrigated lands. It is also recognized that benefits from irrigation spread widely through various services and functions for transportation, merchandizing, processing of farm products and in the manufacture of equipment and supplies utilized on the farm. These benefits accrue to (1) The farmer who lives on the land, (2) To local urban and community centres, to municipalities and the province and (3) To the country at large in increased capital wealth and the maintenance of employment and business activity.

These benefits are presented in a paper included in a report of the Committee on Western Water Problems of the Engineering Institute of Canada in the issue of the Engineering Journal, May, 1941, entitled "Economic Development of Irrigable Lands", by Mr. D. W. Hays.

Irrigation authorities concur in the general division of benefits indicated therein but the proportionate percentage benefits stated in the paper cannot be applied to irrigation conditions in Western Canada because of the lack of the necessary statistics.

DESCRIPTION OF THE PHYSICAL FEATURES OF THE AREA

The area of the proposed St. Mary and Milk Rivers Development is divided naturally into numerous distinct tracts by deep, wide coulees which commence in the western limits and cross the area in a southeasterly direction while the general slope of the land is to the northeast. The various tracts may be grouped into two main areas including, (1) the Grassy Lake, Burdett, Bow Island and Seven Persons Districts extending east of Taber, and (2) the Milk River, Warner and New Dayton area extending from the lower slope of the Milk River ridge. In addition the existing projects of Raymond, Magrath, Alberta Railway and Irrigation, and Taber would be enlarged.

TOPOGRAPHY

Surface and topographical conditions vary throughout the different parts of the area. The steepest slopes are found in the area along the lower limits of the Milk River ridge. However, lands too rough or steep for irrigation are excluded and fully one-half of the total area in the proposed extension is rated from very good to excellent in respect to topography. The surface conditions in the northeastern area are particularly favourable for irrigation.

CLIMATE

The greater part of the project is in the area of low rainfall in southern Alberta, where the average annual precipitation is less than 12 inches. Frequent Chinook winds from the southwest during the growing season cause relatively high temperatures. Much of the limited precipitation occurs in comparatively light rainfalls, and consequently a large proportion is lost by evaporation.

Precipitation increases somewhat towards the western part of the area and to the south towards the Milk River ridge where the climate is influenced to some extent by the higher altitude. However, all of the area is in the short-grass country where drought, because of the limited precipitation and unfavourable distribution, is the major agricultural problem. The average annual precipitation at Medicine Hat, to the east of the project, is 12.91 inches, while the precipitation at Lethbridge on the western boundary averages 15.25 inches annually. These averages indicate only in a general way the climatic conditions in either district since the three major factors affecting production are: (1) the distribution of rainfall during the growing season, (2) the frequency of years of low precipitation, and (3) high evaporation losses.

In most years moisture conditions at the beginning of the season are favourable and crop prospects usually appear promising. Frequently, crops suffer heavily or are completely destroyed by drought and heat in late June or July and any subsequent rains are of little value. Precipitation records are not available for all parts of the project but the effect of climate on agricultural production is probably more accurately indicated by yields obtained. For instance, the precipitation at Lethbridge or Medicine Hat would produce much larger yields in areas of lower temperatures and evaporation, such as northern Alberta or Saskatchewan. During the past 20 years wheat yields throughout the area have averaged 11.7 bushels per acre, varying from 3.7 bushels in 1936 to 30 bushels per acre in 1927 when total precipitation for the year exceeded 25 inches.

COMPARISON OF MONTHLY PRECIPITATION AND MEAN TEMPERATURES AT MEDICINE HAT AND LETHBRIDGE

Months	Average Monthly Precipitation in inches		Monthly Mean Temperatures	
	Medicine Hat	Lethbridge	Medicine Hat	Lethbridge
January.....	0.61	0.57	13.0°	15.0°
February.....	0.54	0.69	15.3°	12.4°
March.....	0.59	0.79	27.9°	27.6°
April.....	0.75	1.12	44.8°	42.7°
May.....	1.62	1.82	55.3°	50.8°
June.....	2.46	2.80	63.0°	58.4°
July.....	1.80	1.75	69.4°	65.0°
August.....	1.42	1.44	65.1°	63.5°
September.....	1.16	1.94	55.9°	53.1°
October.....	0.59	0.91	45.3°	46.0°
November.....	0.69	0.72	29.9°	29.8°
December.....	0.68	0.70	19.4°	23.8°
Totals and yearly averages.....	12.91	15.25	42.0°	40.7°
Totals and averages—April to October inclusive.....	9.80	11.78	56.8°	54.2°

Climatic conditions over the area are indicated in the following yields of wheat obtained at several shipping points over a period of five years.

Shipping Points	Average yields—bus. per acre				
	1936	1937	1938	1939	1940
Purple Springs.....	3	3	12	20	12
Grassy Lake.....	4	3	10	14	9
Burdett.....	3	2	7	10	10
Bow Island.....	3	3	5	6	10
Seven Persons.....	3	3	12	12	11
Warner.....	5	10	24	15	20
Milk River.....	5	10	21	9	18
New Dayton.....	4	12	19	18	17

These yields indicate the hazard of dry-land farming throughout this area. However, it should be pointed out that the low precipitation and high temperatures which make dry-land farming so hazardous give irrigation a high agricultural value. Long days of sunshine and long frost-free periods generally associated with the higher temperatures that prevail where precipitation is light not only add to the yields of staple crops produced on irrigated land, but also add to the variety of specialized crops that may be grown. Climatic conditions over the proposed development are, in the main, very similar to conditions on the Taber Project where climate and soil are important factors contributing to the outstanding results being obtained.

SOILS

A tentative soil rating of the area of the proposed development was prepared for the Committee by the Department of Soils, University of Alberta, as a result of soil surveys of the northern area of the proposed extension made in 1923-1925 and of surveys of the Milk River area made in 1938 and 1939.

The factors which were given consideration in this rating were soil, topography, stones, and alkalinity. The soils have been sub-divided into three classes: (a) doubtful or poor, (b) fair, (c) good.

(a) Doubtful or poor class comprises:

1. Soils where alkali accumulation or seepage was evident at the time of survey.
2. Area broken by erosion, coulees or drains that carry alkali.
3. Soils of a light sandy texture with rough or choppy topography, gravel or stones.
4. Areas where sand dunes have been indicated on the township plans.

(b) The fair class comprises:

1. Solonetz soils—commonly referred to as blow-out, burn-out or slick spots.
2. Light sandy soils and sands with uniform topography.
3. Soils of good medium textures but having rough topography, considerable stones or gravel or where cut by drainage ways that might become alkaline.
4. Soils of heavy textures that would be difficult to handle under irrigation.

(c) The good class comprises:

1. Soils of medium textures, having few or no stones and of fairly uniform topography.

More detailed surveys will be required particularly in the case of the areas tentatively rated as doubtful and poor. However, a large proportion of the soil is listed as good, and according to Dr. F. A. Wyatt compares favourably with any soil in Alberta for irrigation purposes.

The tentative soil ratings prepared by the Soils Department deal with an area of about 950 square miles or some 610,000 acres including 345,000 acres of the lands irrigable from the proposed project. The total area, 43 per cent of which is non-irrigable, was classified as comprising 55 per cent good soil, 37 per cent fair, and 8 per cent poor or doubtful soil. The total acreage of good land that would be irrigable from the proposed development far exceeds that for which sufficient water can be made available. It is, therefore, advisable to select lands for irrigation so that the greatest benefits will accrue to the area as a whole.

CROPS GROWN

The original settlers on small holdings have largely been replaced in the area of the proposed St. Mary and Milk Rivers Development by large-scale wheat growers using power equipment. According to the census reports the wheat acreages in the seven municipal units of the area dropped from 236,188 acres in 1920 to 182,774 acres in 1925, but increased to 281,201 acres in 1930 and to 392,266 acres in 1935 when land sown to wheat comprised 89 per cent of the total crop acreage. Oat acreages dropped from 12 per cent in 1920 when horses were the principal source of power to 4.5 per cent in 1935 when farming had become largely mechanized. The acreages sown to rye varied from 4 per cent to 9 per cent, and the acreages sown to flax, barley, cultivated hay and potatoes averaged less than 2.4 per cent.

LIVE STOCK STATISTICS

Seven of the municipal districts to which the development would eventually extend, not including Seven Persons, had a live stock population in 1936 of 10,500 horses, 23,269 cattle, 63,480 sheep and 9,725 swine compared with 16,301

horses, 28,278 cattle, 20,496 sheep and 10,492 swine in 1916, the first year for which live stock census records are available for municipal districts. The 1936 records showed a decrease of nearly 36 per cent in the number of horses and 18 per cent in the number of cattle. The sheep population more than trebled during the 20-year period and the swine showed a decrease of a little more than 6 per cent.

POPULATION

The population density within the proposed irrigation development averaged 3.44 persons to the square mile in 1936. The four improvement districts in the southwestern section of the area, including Warner and Milk River, show a fairly uniform, though very small, increase in population since settlement began early in the century. On the other hand, settlement in the northeast, including the municipal districts of Bow Island, Fortymile, and Eureka, was more rapid. With railway facilities available since the commencement of settlement, this area was largely settled by 1911 when the population density had reached an average of 4.96 and in some districts exceeded 6.50 persons to the square mile.

The soil was fertile and with abundant June rains the grass-covered prairies offered what seemed abundant opportunity for settlement. Some settlers, probably, recognized signs of disaster in the crop failures of 1910 and 1914. However, with the bumper crop of 1915 and the good yields of 1916 and 1917 and with high prices prevailing, there was little loss of population until the exodus of the early twenties which followed a succession of crop failures and the end of the post-war boom. By 1926 the population of the area had declined to an average of 3.16 to the square mile. In one municipality the rural population in 1926 was less than 40 per cent of what it had been in 1911 and little over 30 per cent of what it had been in 1916. Likewise, the towns and villages in the north-eastern area showed the highest populations in 1916 and 1921 with losses, or only very small gains, since 1921. The town of Bow Island, for example, had a total of 307 people in 1911 and 308 in 1936 compared with 427 in 1921. Census records of the area since 1901 are given in Table VIII.

AGRICULTURAL AND DIRECT RELIEF

Relief costs in the area have been moderately low compared with those in other drought areas of the Prairie Provinces. Two main factors contributed to this relatively favourable condition. First, a large part of the population moved from the district most affected by drought, soon after settlement, and second, the effects of subsequent drought years were mitigated because feed, vegetables and other essentials were available at reasonable costs from the irrigated areas to the west. Also many dry-land farmers found employment on irrigated farms after their own crops had been destroyed by drought. Variations in relief cost have been due, in part, to differences in soil and rainfall.

In the five municipal districts included in the proposed development which are farthest from existing irrigation projects and where the population in 1935 numbered 4,086, the total unrepaid agricultural advances amounted to \$879,416 or \$215.23 per person. Direct relief for the same area cost \$77,086 or \$18.87 per person making a total relief cost of \$234.10 per capita. In contrast the cost of relief in the municipal districts partly irrigated or adjacent to irrigation districts averaged \$21 per person comprising \$11.80 for unrepaid agricultural advances and \$9.20 for direct relief.

VALUE OF DRY LAND IN AREA OF PROPOSED EXTENSION

The various tracts of land irrigable from the proposed St. Mary and Milk Rivers development show wide variation in values for dry land because of the differences in rainfall and soil, averaging from \$2.90 per acre in the municipal

district of Bow Island (No. 94) to \$15.70 per acre in the Raymond area. The appraised value of 3,408 quarter-sections included in the proposed development averaged \$6.65 per acre, according to information obtained from the Alberta Water Resources Office. Following are valuations by municipal units for the quarter-sections included in the area, but excluding the Seven Persons area.

Municipal Unit	Number of Quarter- sections	Total Valuation	Average Valuation per Acre
		\$	\$ cts.
Milk River No. 5 (East).....	416	345,630	5 20
Milk River No. 6 (West).....	182	342,040	11 80
Improvement District No. 35.....	186	191,180	6 50
Warner District No. 36.....	572	880,410	9 60
Improvement District No. 37.....	215	540,900	15 70
Improvement District No. 66.....	448	429,390	6 00
Fortymile District No. 64.....	464	326,560	4 40
Eureka District No. 65.....	815	527,600	4 00
Bow Island District No. 94.....	110	50,485	2 90
		3,634,195	

Average— \$6.65 per acre.

\$1,066.00 a quarter-section.

The land values in this area are based mainly on wheat production and vary with precipitation and to some extent with the type of soil. The lower valuations of the lands adjacent to and east of the Taber project are a direct result of low precipitation where irrigation has a correspondingly high value.

PLAN OF ULTIMATE DEVELOPMENT

Under the terms outlined by the Order in Council, the Committee was directed to make a thorough study of the additional works required to fully utilize the share of the waters of the St. Mary and Milk Rivers apportioned to Canada.

The Committee, therefore, has considered the ultimate limits of the proposed project and find, that while an excess of suitable land is available, the project is limited by the water supply to an area of 465,000 acres. This area includes approximately 120,000 acres in existing projects for which there has been an insufficient water supply from the existing works.

GENERAL PLAN

The ultimate development at present proposed to utilize the available water supply is an extension and enlargement of the present system now in operation from the St. Marys River supplemented by storage on the streams and further supplemented and regulated by a system of secondary canals and reservoirs strategically situated throughout the irrigable area as shown on Plan, Appendix F.

The general map attached to this report as Appendix F shows the most economical and feasible development as now conceived, but it is probable that changes will be necessary from time to time as the lands are developed to meet new demands and conditions which may arise during the construction period. In order to serve the ultimate development of 465,000 acres, the following essential features are required:—

- (1) A reservoir of at least 28,000 acre-feet on the Waterton River.
- (2) A canal of 1,100 second-feet capacity from the Waterton River to the Belly River.

- (3) A canal of 1,700 second-feet capacity from the Waterton River to the St. Mary River.
- (4) Storage capacity on the St. Mary River in Canada of at least 270,000 acre-feet.
- (5) A canal of 3,000 second-feet capacity from the St. Mary River reservoir to the present canal system.
- (6) A high line canal crossing Chin Coulee to serve the large area between Chin Coulee and the Oldman River above the low level canal from Chin Reservoir.
- (7) A high line canal to lands east of Fortymile Coulee and pumping facilities to elevate water to lands above the gravity system.
- (8) Diversion works and supply canals from Milk River to Verdigris Lake together with the necessary distribution system to irrigate lands in the Milk River and Warner Districts.
- (9) Supplementary storage as follows:—

Milk River Ridge reservoir.....	80,000	acre-feet
Raymond reservoir	16,900	" "
Verdigris reservoir	140,000	" "
Chin reservoir	150,000	" "
Milk River Forks reservoir	31,000	" "
East Pothole reservoir	14,000	" "
Sevenpersons Creek reservoir (two)	1,600	" "
Horsefly reservoir	6,000	" "

In preparing the water supply estimates the following assumptions were made:—

- (a) Reservoir losses as follows:—

April	0.2	foot in depth over exposed area
May	0.3	" " " " " "
June	0.4	" " " " " "
July	0.5	" " " " " "
August	0.6	" " " " " "
September	0.4	" " " " " "
October	0.2	" " " " " "
November to March inclusive 0.1		

- (b) Canal losses based on absorption at the rate of 6 second-feet per one million square feet of wetted area reduced to percentage loss per mile for canals of various capacity.
- (c) Water requirements for the irrigable lands estimated on the basis of supplying 80 per cent of the total irrigable area with a depth of 1.5 acre-feet per acre per year.

SUITABILITY OF NEW LANDS

Surveys and investigations over a period of more than forty years have demonstrated that there are large areas of irrigable lands lying to the east of the St. Mary River between the Milk and Oldman Rivers and extending as far east as Medicine Hat.

Local ridges and depressions separate the irrigable lands and tend to isolate some good lands and make others difficult and costly to supply with water. A natural division of the whole area by drainage lines is as follows:—

- (1) Lands along the slope of the Milk River ridge south and west of the depression formed by Stirling Lake, Tyrrell Lake, and Verdigris Coulee.
- (2) Lands between Chin Coulee and the Oldman River lying to the north of the Stirling Lake and Tyrrell Lake depressions and to the west of Chin Coulee.

- (3) Lands between Chin Coulee and the Oldman River lying to the east of Chin Coulee and west of Fortymile Coulee.
- (4) Lands between Chin and Etzikom Coulees in the Legend and Foremost District.
- (5) Lands between Etzikom and Verdigris Coulees and the Milk River.
- (6) Lands south of the Oldman River between Fortymile Coulee and Medicine Hat.

All of the lands in the Magrath and Raymond Districts are included in the first division but there are some additional lands which may ultimately be irrigated. These lands are similar to those now irrigated. The area is more rolling and the precipitation a little higher and the soil for the most part a little heavier than in the other divisions.

The largest tract of unirrigated land in this division is in the Milk River and Warner Districts to be served by the proposed diversion from Milk River. Because the precipitation in this area is higher than in other areas and the soil a little heavier, irrigation is not as necessary as it is farther east.

The second division contains all of the lands now irrigated in the Lethbridge-Coaldale area. There are, however, some small areas particularly in Township 10, Range 19, to which irrigation can be extended. These lands are all very similar to those now irrigated.

The Taber District includes the only land now irrigated in the third division, but there are large tracts which may be served partly by an extension of the main Taber District canal and partly by the proposed high line canal crossing Chin Coulee at about 2,900 feet above sea-level. This division contains the largest and most compact irrigable area in the proposed project. Climate and soil conditions are similar to those in the Taber District where irrigation has been carried on successfully for a number of years, but much of the area has a better slope and can be more readily irrigated than the Taber District.

Some of the best lands in Alberta for irrigation are contained in the area covered by the following townships:—

- Township 7, Ranges 11 and 12, West 4th Meridian;
- Township 8, Ranges 11, 12, 13 and 14, West 4th Meridian;
- Township 9, Ranges 12, 13 and 14, West 4th Meridian.

Lands further north, particularly along the Oldman River, are more rolling and contain only scattered areas adaptable to irrigation.

The soil throughout is all very similar in character consisting mostly of light clay loam changing to a light sandy loam towards the north. Along the banks of the Oldman River the soil becomes distinctly sandy and there are small sand ridges directly bordering the river banks.

In the fourth division there is a comparatively small area of excellent land between Legend and Foremost which could be irrigated by a long canal from Verdigris Lake crossing Etzikom Coulee near the east boundary of Township 5, Range 15. The estimated cost of this canal, however, is so great, that present plans do not provide for the inclusion of these lands.

The irrigable lands contained in the fifth division, while located in one of the driest areas in the project, are more rolling and broken with no very definite slope or good drainage. The soil is fairly light and there are indications of alkali in the lower areas. There is a fairly large area of better lands along the east slope of Pakowki Lake which might be served by a long canal along the south slope of the Lucky Strike hills, but as in the case of the Legend and Foremost lands the cost of the necessary supply canal is too great, and the present plans do not provide for the inclusion of these lands.

Part of the area included in the sixth division might be served by a canal crossing Fortymile Coulee at a moderate height, although some of the lands are too high to be irrigated by this method. The plans of the proposed development provide for a pumping station to elevate the water to serve these higher lands.

Surveys are now being made to determine the limits of the irrigable area in this tract, but it is recognized that there are very large areas of lands having suitable topography and soil, and the limiting factor will be the available water supply.

ST. MARY RESERVOIR

The proposed reservoir on the St. Mary River near Spring Coulee is essential to any further development—first, to increase the water supply to land now irrigated for which the present supply is inadequate; second, to protect a right, through beneficial use, to Canada's treaty share of the St. Mary River.

Whether the use of this reservoir is intended for partial or full development of the lands by irrigation, the physical features at the site of the dam and works incidental to the dam, i.e., outlet works and spillway, require the dam to be built, for practical reasons, to the full size consistent with ultimate requirements. There is no deviation from this, except perhaps in the size of the tunnel outlet, although any decrease in size of the latter would be improvident in view of possible future requirements.

The cost of the dam and appurtenant works, with a connecting canal to existing works at Spring Coulee, is estimated at approximately \$3,848,000, or more than 32 per cent of the estimated total cost of the development. Since this sum must be expended before any additional land can be irrigated it would seem expedient to distribute this cost over as large an area as can be irrigated from the reservoir.

When the St. Mary reservoir is built the remainder of the development possesses flexibility both as to time of construction and with respect to the different areas in the project which may be brought under development.

ULTIMATE IRRIGABLE AREA

Consideration has been given—first, to the extent to which water of the St. Mary River may be utilized; second, to the extent to which waters of the Milk River may be utilized; and third, the ultimate extent to which all available waters common to the proposed project may be utilized. On this basis the following lands would be irrigated:—

St. Mary River (by storage in St. Mary reservoir and Chin Coulee reservoir)		
Existing projects	120,000 acres	
New lands	94,000 "	
		214,000 acres
Milk River (by storage at Milk River Forks reservoir and by utilization of Verdigris Reservoir)—new lands		
		18,380 "
Belly and Waterton Rivers (by diversion into the St. Mary reservoir and supplemented with reservoirs within the project)—new lands		
		232,620 "
Total Irrigable Area		465,000 "

CONSTRUCTION COST

While detailed estimates of cost have not yet been made, fairly close preliminary estimates have been compiled by revising the estimates made some years ago by the Dominion Reclamation Service and re-estimating most of the

larger canals and structures. A summary of these costs for the irrigation ultimately of 465,000 acres, based on unit prices prevailing in 1939 and 1940, is:—

Reservoirs	\$ 5,349,734
Main canals	4,841,410
Distribution canals	2,195,520
Power development	327,470
Total	\$12,714,134

It is assumed that no part of the cost will be charged to the 120,000 acres in existing projects, as these lands are already served by works to the extent of available water supply, and also because a part of the existing works will be incorporated in the proposed development. That is, there are 345,000 acres of new irrigable lands included in the proposed project. The total estimated cost and cost per acre of the development are shown in the statement which follows:—

	Construction Costs	Costs per Acre
St. Mary River utilizing Canada's share for the irrigation of 94,000 acres:		
Dam and appurtenant works	\$ 3,848,349	
Chin reservoir, canals, and distribution system...	2,566,184	
Cost for 94,000 acres	\$ 6,414,533	\$68 24
Add: For diversion of waters from Belly and Waterton Rivers into St. Mary reservoir, and for supplementary reservoirs, canals and distribution system for an additional area of 232,620 acres	\$ 5,764,416	\$24 78
Total cost for 326,620 acres	\$12,178,949	\$37 17
Milk River, Canada's share:		
Applicable to 18,380 acres, reservoir, canal and distribution system	535,185	\$29 10
Total construction cost for 345,000 acres.....	\$12,714,134	\$36 85

The logical first stage of development is to supply water to existing projects and the 94,000 acres of additional irrigable land which may be served by Canada's share of the waters of the St. Mary River. Thereafter, the order of development of the various tracts of land within the proposed project may be varied and may be undertaken by stages at such a rate as may be required to meet the needs of land settlement or other conditions.

For the purpose of estimating and as a reasonable construction program, the development of the ultimate area is provided for in ten stages distributed over a period of fourteen years as discussed under the heading "Construction Program Proposed."

TOTAL CAPITAL COST

The total construction cost, estimated at \$12,714,134, is based on general surveys with some greater detail for the larger canals and structures. This is an average cost per acre of \$36.85. Certain additional costs will arise in the development of the project, namely:—a discrepancy between the costs of operation and maintenance and service charge collections during the first few years following construction and before settlement is complete; the cost of colonization and supervision, advice and services to new settlers with the object of aiding them in the adoption of successful irrigation practices. Since nearly all irrigable lands require some surface improvements to facilitate even

distribution and economical use of water, provision is also made to include the cost of land preparation as a part of the capital investment. These several costs, extending over a period of fourteen years, have been estimated as follows:

Capital account—		
Construction of works per acre	\$36 85	
Land preparation	3 00	
		\$39 85
Revenue account—		
Deficit in operation and maintenance	\$ 2 54	
Colonization costs	1 00	
Agricultural advice and services .....	.60	
		\$ 4 14
Total estimated outlay per acre		\$43 99

These estimated costs are not thought excessive in consideration of the benefits anticipated from the irrigation of the lands and compare favourably with expenditures on other large irrigation developments.

OPERATION AND MAINTENANCE

Some operation and maintenance deficits during the development and construction period will probably have to be absorbed. To predict what these may amount to is impossible as conditions on the existing irrigation projects are not comparable to the conditions which may obtain in this development. A method is, however, submitted which may give some idea of what these costs may be and it is believed that the figures are conservative.

The method is based on the following assumptions:—

1. That newly developed tracts or districts will not be able to pay water service rates during the first three years of operation.
2. That the annual cost of operating these districts during this period will be \$1 per irrigable acre.
3. That when, at the end of 17 years, all districts are on a paying basis, water can be delivered to the headgates of the districts at an annual cost of 50 cents per irrigable acre.
4. That ultimate costs may be summarized as follows:—
 - (a) Operation only, \$186,000 yearly equals 40 cents per acre.
 - (b) Replacement of structures, \$80,000 yearly.
 - (c) Maintenance of permanent works, \$36,500 yearly.
5. That operation cost in 4 (a) will vary in direct proportion to the area served, and that replacement and maintenance costs in 4 (b) and 4 (c) will vary according to the stage of development.

All the above assumptions are based on the best information obtainable from existing districts. For instance, the annual operation and maintenance costs in the Taber District have averaged about 50 cents per irrigable acre. The Canadian Pacific Railway Company delivers water to the Taber headgates for 50 cents per acre, making the total annual cost \$1 per acre for water service. This tends to confirm Assumptions 2 and 3.

Operation cost in 4 (a) was arrived at by estimating the cost of an operating and administrative organization capable of handling the main works of the ultimate project. Replacement cost in 4 (b) is an estimated annual sum to renew at the end of thirty years all main canal structures of limited life, such as siphons, flumes, and headgate structures. The entire cost of the main canal system is represented by these structures with the exception of the cost of the earthwork. Maintenance cost in 4 (c) is the balance available from the revenue from the entire area at 50 cents per acre, plus net revenue from power,

and is therefore predicated on Assumption 3. It appears to be a reasonable figure for the maintenance of the seven reservoirs, which will be comparatively durable structures consisting chiefly of earthwork, rock, and concrete.

Table VII in the Appendix is computed on the assumptions outlined, and the yearly operation and maintenance deficits which may have to be absorbed are shown in Column 9. The estimated total is \$877,301 and amounts to \$2.54 per acre for the 345,000 acres of new land.

According to the proposed construction program for fourteen years, no structures will be completed until the end of the third year. Since construction estimates allow for maintenance during the first year after completion, it follows that operation and maintenance costs will not appear until the beginning of the fifth year of construction.

It must again be emphasized that the estimates in Table VII are only tentative as the future prices of farm products, future construction costs, climatic conditions during the development period, immigration, and many other conditions may greatly influence the estimates. If there should be a great demand for irrigated land, and farm produce prices are favourable, it is possible that the available land may be disposed of as each tract becomes available and that each owner's earnings will be sufficient to meet his obligations from the beginning. If this eventuates the construction program may be considerably shortened with consequent lower total costs.

POWER DEVELOPMENT

Some of the irrigable lands east of Fortymile Coulee are above the elevation of the main canal in this area and can only be served by means of pumping to raise the water to a high level canal. To provide the necessary power for pumping, it is proposed to utilize drops to be constructed in the main canal between the St. Mary River and Chin Coulee.

Low-cost power stations installed at these drops will, in addition to supplying the necessary power to pump a supply of water to higher levels, generate power for sale by the transfer of water during the winter from the St. Mary River reservoir to the Chin Coulee reservoir.

If the operation of these canals during the winter is feasible, it is estimated that 9,390 continuous horse-power can be developed for five months during the winter at an operating cost of approximately \$50,000 which, if disposed of at one-half cent per kilowatt-hour, will provide a net revenue each year of \$70,000. This revenue, if applied to the operation and maintenance of the project, will amount to 15 cents per acre.

CONSTRUCTION PROGRAM PROPOSED

The extension of water diversion from the St. Mary, Milk, Belly, and Waterton Rivers may be readily adapted to any orderly program of irrigation development. The St. Mary storage reservoir must be included in the first stage and certain broad principles of development must necessarily be observed, but otherwise any desired acreage can be developed yearly to suit conditions.

ORDER OF DEVELOPMENT AND PERIOD REQUIRED FOR COMPLETION

The history of existing irrigation projects reveals, as already indicated, that many of the difficulties experienced, financial and otherwise, resulted from over-development. Development was too rapid for the existing conditions and for the conditions which followed. As colonization did not keep pace with the development, arrears of principal, interest, and service charges accumulated.

Future conditions may be such that it might be desirable to develop the whole project as a unit, in which case construction could be completed in four to five years.

On the assumption that rehabilitation requirements following the war might lead to the settlement of from 25,000 to 40,000 acres of irrigated land annually, a 14-year construction program has been prepared. This period is tentative and could be lengthened or shortened as conditions might require.

General factors governing the order of development are: The early utilization of Canada's share of the St. Mary River; the demand for irrigated land; and economy of expenditure to meet the above conditions. With the foregoing as a guide the logical development of what may be regarded as the first stage would be as follows:—

1. Construction of St. Mary reservoir, along with outlet canals to Chin reservoir.
2. The enlargement of Chin reservoir, along with enlargement of outlet canal.
3. The orderly development of the 94,000 acres of irrigable land necessary to utilize the remaining portion of Canada's share of the water of the St. Mary River.

ST. MARY RESERVOIR

The proposed reservoir in the St. Mary River Valley near Spring Coulee is the key structure of the entire development. The completion of St. Mary Dam creating this reservoir and the short outlet tunnel and canal from the reservoir to the existing works is the first step necessary to deliver water for the irrigation of additional lands.

The construction of the proposed St. Mary Dam will be the largest and most costly item of the development and three years will be required for its completion. The dam has been designed as an earth fill, 186 feet in height and approximately one-half mile along the crest. Its length across the river bed, however, is only 300 feet and as the banks are fairly steep for approximately 100 feet above the river bed, the quantities for this type of dam are not excessive.

The quantities are approximately as follows:—

Earth fill	3,600,000	cubic yards
Rock excavation	242,000	" "
Rock and gravel fill	110,000	" "
Rock riprap	32,000	" "
Concrete	35,000	" "

To discharge the necessary 3,000 cubic-feet per second to irrigate the full development (465,000 acres) an outlet tunnel 20 feet in diameter and 2,900 feet in length with regulating gates will be constructed about 90 feet above the river bed. A spillway will be constructed about one-quarter mile west of the end of dam with a discharge capacity of 20,000 cubic-feet per second when the reservoir is full. This spillway will discharge to the St. Mary River about one-half mile downstream from the dam. A lake will be created about fifteen miles in length with a maximum width of six miles with a total storage capacity of about 310,000 acre-feet of which the effective capacity is 270,000 acre-feet. The estimated cost of the dam and outlet works is \$3,848,000.

Surveys of the reservoir site, test borings of the dam site, and preliminary design of the structure were carried out by the Engineering Staff of the P.F.R.A. organization. A report as to the geological features of the dam site was prepared by Dr. John A. Allen of the University of Alberta. Also through the courtesy of Mr. G. A. Gaherty, Chairman of the Western Water Problems Committee of the Engineering Institute of Canada, arrangements were made to have the site inspected by Dr. T. H. Hogg, Chairman of The Hydro-Electric

Power Commission of Ontario. Dr. Hogg has had wide experience in the design and construction of the type of dam proposed and has expressed his general approval of the design of dam and appurtenant works in the following terms:—

"From my inspection of the site, it appears to me that the type of dam proposed, viz., an earth fill structure, is best suited to the conditions existing and that such a structure would be quite feasible. While some question has been raised as to seepage through the foundations, it would appear to me to be quite possible to meet such conditions with reasonable methods. The placing of a blanket of waterproof material upstream from the dam might offer the simplest solution, although other methods such as cutoff walls and grouting might prove advisable after further consideration. These latter alternatives have some disadvantages in that it might prove unadvisable to disturb the foundations any more than is necessary to permit of a good bond between the earth fill and the rock.

"Several alternative layouts for the Spillway, Unwatering, Power and Discharge works and Irrigation Outlet works have been studied by the engineers engaged on this work, and estimates of the cost of each prepared.

"The final arrangement of these various features will, of course, require careful consideration of all the factors involved, including the estimated cost, although the latter will not necessarily be the determining factor.

"The estimates prepared by Mr. Foss and included in his memorandum of October 31st, 1941, appear to be reasonable for the quantities involved, but I would suggest that they be reviewed in the light of present day conditions and prices."

LANDS TO BE INCLUDED IN FIRST STAGE OF DEVELOPMENT

The lands included in the first stage would be those served by Chin reservoir, and adjacent to the Canadian Pacific Railway right of way between Taber and Medicine Hat. It is in this area that the greatest need and most urgent demand for irrigation occurs. This area includes tracts numbered 1 to 9 on the general plan which are proposed to be developed in the following order:

Constructed Third Year—Grassy Lake and Burdett Tracts.....	24,598	acres
Constructed Fourth Year—Yellow Lake and Purple Springs Tracts	27,161	"
Constructed Fifth Year—Big Bend and Medicine Hat.....	42,424	"
Total	94,183	"

MAIN CANALS AND SECONDARY RESERVOIRS

Further development involves the utilization, first, of the waters of the Belly River, and second, of those of the Waterton River as well as the necessary development to utilize Canada's share of the Milk River. The Milk River Development constitutes a unit almost complete in itself, and could be constructed at any time, either early or late in the program. The proposed program contemplates the development of the Milk River in its later stages.

Secondary reservoirs and feeder canals will be constructed as required, the order depending to some extent upon the location of lands selected for development. According to the present program, however, the secondary reservoirs will be constructed in the following order:—

Chin reservoir enlargement	150,000	acre-feet	capacity
Horsefly Lake reservoir	6,000	"	"
East Pothole reservoir	14,000	"	"
Milk River Ridge reservoir.....	80,700	"	"
Raymond reservoir	16,900	"	"
Verdigris reservoir	140,500	"	"

Main canals will be constructed as required, in order to serve the lands selected for development. The order proposed is as follows:—

- Enlargement of Taber Canal.
- Main Canal to Medicine Hat District.
- High Line Canal across Chin Coulee.
- Main Canal to New Dayton District.
- Main Canal to East Verdigris District.
- Main Canal to Milk River District.

PROPOSED CONSTRUCTION PROGRAM WITH ESTIMATED YEARLY EXPENDITURES

The proposed 14-year construction program, showing stages and estimated yearly outlays, follows. It will be noted that yearly outlays include not only capital expenditures, but also estimated operation deficits and other items of revenue account.

The unit costs for construction used in compiling estimates are based on prices prevailing in 1939 and 1940 as follows:—

Common excavation	\$ 15	per cubic yard
Canal excavation	12	" " "
Rolled fills in place	20	" " "
Tunnel excavation	4 00	" " "
Rock excavation, open cuts	1 00	to \$2.00 per cubic yard
Rock riprap in place	1 50	per cubic yard
Reinforced concrete	23 00	" " "
Timber construction in place	85 00	per 1,000 F.B.M.
Structural steel in place	200 00	per ton
Overhaul	05	per station yard
Round piling	85	per linear foot

These estimates should be revised to unit costs prevailing when construction is undertaken.

	Estimated Cost	Estimated Yearly Expenditure
<i>Stage 1</i>		
<i>First Construction Year</i>		
St. Mary reservoir	\$ 750,000	\$ 750,000
<i>Second Year</i>		
St. Mary reservoir and outlet canals.....	2,250,000	2,250,000
<i>Third Year</i>		
St. Mary reservoir and canal enlargements	2,114,764	
Distribution system 24,598 acres	141,721	
	<hr/>	2,256,485
<i>Fourth Year</i>		
Enlarge Chin reservoir	170,910	
Main canals	127,535	
Distribution systems 27,161 acres.....	165,768	
Land levelling	73,794	
Colonization and agricultural advice	39,357	
	<hr/>	577,364
<i>Fifth Year</i>		
Canals	244,600	
Distribution systems 42,424 acres.....	297,755	
Chin Power plant—3,540 h.p.....	151,470	
Land levelling	81,483	
Colonization and agricultural advice	43,457	
Operation and maintenance deficit	52,098	
	<hr/>	870,863
Total outlay—1st stage		\$ 6,704,712
New land irrigated, 94,183 acres.		

	Estimated Cost	Estimated Yearly Expenditure
<i>Stage 2</i>		
<i>Sixth Year</i>		
Canal, Belly River to St. Mary reservoir.....	\$ 783,924	
Lethbridge-Coaldale tract, 24,173 acres.....	96,692	
Land levelling	127,272	
Colonization and agricultural advice.....	67,878	
Operation and maintenance deficit	61,559	
		\$ 1,137,325
<i>Stage 3</i>		
<i>Seventh Year</i>		
Canal, Waterton River to Belly River.....	383,100	
Main canals	484,009	
East Chin District system, 39,184 acres.....	147,618	
Land levelling	72,519	
Colonization and agricultural advice	38,677	
Operation and maintenance deficit.....	89,885	
		1,215,808
<i>Stage 4</i>		
<i>Eighth Year</i>		
Canal, Spring Coulee to Milk R. Ridge reservoir	464,642	
East Pothole reservoir	189,358	
Milk River Ridge reservoir.....	303,507	
Distribution systems, 38,414 acres.....	308,171	
Land levelling	117,552	
Colonization and agricultural advice	62,694	
Operation and maintenance deficit	120,965	
		1,566,889
<i>Stage 5</i>		
<i>Ninth Year</i>		
Main canals	149,305	
Raymond reservoir	228,400	
Distribution systems, 23,144 acres	261,259	
Power Plant East Pothole, 5,840 h.p.	176,000	
Land levelling	115,242	
Colonization and agricultural advice	61,462	
Operation and maintenance deficit	125,113	
		1,116,781
<i>Stage 6</i>		
<i>Tenth Year</i>		
Main canals	318,600	
Verdigris reservoir	309,284	
Distribution systems, 30,645 acres.....	126,093	
Land levelling	69,432	
Colonization and agricultural advice	37,030	
Operation and maintenance deficit	79,595	
		940,034
<i>Stage 7</i>		
<i>Eleventh Year</i>		
Waterton River reservoir	410,906	
Main canals	56,037	
Distribution systems, 31,166 acres	200,838	
Land levelling	91,935	
Colonization and agricultural advice	49,032	
Operation and maintenance deficit	71,963	
		880,711
<i>Stage 8</i>		
<i>Twelfth Year</i>		
Distribution systems, 23,722 acres	179,785	
Land levelling	93,498	
Colonization and agricultural advice	49,866	
Operation and maintenance deficit	63,787	
		386,936

	Estimated Cost	Estimated Yearly Expenditure
<i>Stage 9</i>		
<i>Thirteenth Year</i>		
Milk River Forks reservoir.....	\$ 256,385	
Main canals	195,878	
Distribution systems, 21,988 acres	186,898	
Land levelling	71,166	
Colonization and agricultural advice	37,955	
Operation and maintenance deficit	72,637	
		\$ 820,919
<i>Stage 10</i>		
<i>Fourteenth Year</i>		
Distribution systems, 18,381 acres	82,922	
Land levelling	65,964	
Colonization and agricultural advice	35,181	
Operation and maintenance deficit	62,691	
		246,758
<i>Construction Completed</i>		
<i>Fifteenth Year</i>		
Land levelling	55,143	
Colonization and agricultural advice	29,411	
Operation and maintenance deficit	50,330	
		134,884
<i>Sixteenth Year</i>		
Operation and maintenance deficit		25,480
<i>Seventeenth Year</i>		
Operation and maintenance deficit		1,198
Total estimated outlay		\$15,178,435
<i>Summary</i>		
<i>Capital Account</i>		
Construction cost	\$12,714,134	
Land levelling	1,035,000	
		\$13,749,134
<i>Revenue Account</i>		
Colonization and agricultural advice	552,000	
Operation and maintenance deficit	877,301	
		1,429,301
Total		\$15,178,435

ORGANIZATION REQUIRED

If the recommendations of the Committee as set out on pages 4 to 6 of this Report are accepted in principle, there will be, as a preliminary step, an agreement between the Dominion Government and the Government of Alberta which will clearly define that part of the program allotted to each Government. Briefly the Dominion Government might assume sole responsibility of the construction of works required to store Canada's share of the international waters, and the Province assume sole responsibility for putting these waters to beneficial use.

The Committee is of the opinion that if such an agreement is concluded it may not be necessary to establish an over-all organization to co-ordinate the Dominion and Provincial operations but that existing organization, provincial and Federal, with perhaps some extensions to meet the special requirements, would be able to complete the project.

In connection with the Dominion's part of the program, the Committee desires to point out that the Water Development Branch of the Prairie Farm Rehabilitation Act organization, Federal Department of Agriculture, with headquarters at Regina, has already completed certain surveys and investigations in

connection with the proposed project, and that this organization, with an augmented staff, would be in a position to undertake that part of the program to be assumed by the Dominion.

LEGISLATION AND AGREEMENTS

LEGISLATION

Before the transfer of title to the natural resources of Alberta to the Province in 1931, the granting and administering of surface water rights was a function of the Dominion Government. Early Provincial Acts were the Irrigation Districts Act, 1915, which provided for the organization of irrigation districts and The Water Users' Act of 1920, which provided for the formation of districts or associations which could be served from an existing irrigation system. Various amendments have been made to these Acts.

The procedure in constituting an irrigation district is similar to that in forming a large school or municipal district. The first step is the submission of a petition to the Minister, signed by corporations or by persons owning collectively at least one-half of the lands in the proposed district.

The petition must be supported by evidence showing that the proposed district can be operated satisfactorily. A final vote is taken after any objectors have been given opportunity to submit counter evidence. A two-third majority of the persons voting is necessary if a new district is to be formed.

The Act provides for the election of a Board of Trustees which is a body corporate with power to conduct the affairs and business of the district, but subject in certain respects to the Irrigation Council appointed by the Lieutenant-Governor in Council to advise every Board upon the conduct of the affairs of its district. The Trustees cannot expend money, enter into contracts or fix a rate of assessment without the approval of the Council. An official trustee may be appointed in some cases to take the place of a Board of Trustees.

Since the transfer of the natural resources to the Province, administration of surface waters has been in accordance with the terms of the Alberta Water Resources Act. Persons or corporate bodies wishing to divert surface waters for irrigation must file application with the Director of Water Resources and when the conditions of the Act have been complied with, licence to divert and use water may be granted.

AGREEMENTS

The St. Mary and Milk Rivers Development as proposed would necessitate an extension of the existing system of the Alberta Railway and Irrigation Company controlled by the Canadian Pacific Railway Company. The main canal of the Alberta Railway and Irrigation System would have to be enlarged as the irrigable area of the project would be more than doubled. The existing districts of Magrath, Raymond, and Taber would also be enlarged. The Committee considers that all existing districts served from the St. Mary River and any extensions outlined in this Report should eventually be under one administrative control.

The following statement of the Alberta Railway and Irrigation Company outlines its policy regarding the proposed St. Mary and Milk Rivers Development. This policy was approved on April 17, 1941, by resolution of the Advisory Committee of the Department of Natural Resources of the Canadian Pacific Railway Company. The latter Company owns a controlling interest in the Alberta Railway and Irrigation Company:—

“Upon the setting up of a competent Board or other body having authority to enter into agreements for the construction and operation of the proposed Lethbridge Southeast Irrigation Project (St. Mary and Milk

Rivers Development), the Alberta Railway and Irrigation Co. will be prepared to negotiate an agreement with the Board on the following basis, viz.:—

“1. The A. R. and I. Co. will transfer to the Board, without monetary consideration, all its water rights, irrigation works and agreements for the delivery of water (but not its lands, except Canal and Reservoir right-of-way.)

“2. The Company to receive all necessary assurances for the protection of its rights to collect any money owing to it under existing land contracts, water agreements or other agreements which may be affected by the transfer.

“3. All necessary assurances to be given to landowners, purchasers and Irrigation Districts who are under agreement with the Company, that their rights will be adequately protected.

“4. Holders of water rights under agreements with the Company will be entitled to participate in the use of storage water without capital charge for such rights.

“5. The Company to be released from all further obligations and liabilities in connection with the rights, works and agreements which are transferred to the Board.

“6. The agreement between the Company and the Board to be ratified by the legislative enactment.”

The foregoing resolution provides a basis of negotiation for concluding any necessary agreement respecting interests of the Alberta Railway and Irrigation Project that may be affected by the proposed development.

COLONIZATION AND RE-ESTABLISHMENT

Under existing conditions the Committee is of the opinion that the proposed St. Mary and Milk Rivers Development is important for what it has to offer as a potential rehabilitation project. An importance which, doubtless, will be greatly increased in the post-war period for reasons too obvious to need further elaboration. It is recognized that any policy outlined now might not be appropriate to the conditions likely to be created by the cessation of hostilities and which might even be the greatest justification for formulating a colonization policy in connection with the proposed development. Consequently, the Committee considers that it should do no more at this time than draw attention to some important considerations which should not be overlooked or disregarded and which are indeed basic and fundamental to any plan of colonization and re-establishment.

After much consideration regarding this matter and particularly after inquiring into the plan now in operation under authority of the Prairie Farm Rehabilitation Act, the Committee is favourably impressed with the methods followed by that administration in handling what is generally regarded as a complex and very difficult problem. The policy is based on two main considerations. The first is the procedure whereby municipal and provincial bodies co-operate with one another and with the Dominion through the Prairie Farm Rehabilitation Branch, in a joint effort to permanently remove inferior or non-arable lands from cultivation. These lands are then put to their best economic use and made available as community pasture areas for the use and benefit of surrounding residents, after being fenced, and re-grassed where that is necessary.

The other main consideration is the removal of farmers from these sub-marginal or inferior land areas. These farmers have struggled through many

years, but through adverse conditions have finally found themselves in a hopeless situation; and as long as they are left in their present locations, will be dependent upon state assistance in one form or another.

Obviously, the successful operation of such a policy will depend, first, on the extent to which suitable lands for re-settlement purposes are available, and second, the degree to which individual farmers adjust themselves to irrigation farming. Any policy must be planned with the view of accommodating various individual preferences and the needs of specific cases so necessary to ensure permanent and successful re-establishment. Lands which can be irrigated have important advantages for rehabilitation purposes.

It is therefore considered that a policy, which combines to such a large degree sound land-use practices with individual rehabilitation, can be readily accepted as further justification for the development of feasible irrigation projects.

Individuals with long practical experience in the settlement and operation of irrigation districts agree as to the necessity of maintaining close supervision, particularly during the first few years. It is found in practice that the settler, particularly the dry-land farmer, should have the advice and guidance of specialists in irrigation practices, methods of cropping, and related matters. Experience has shown also that the settler will have a much greater chance of success if the land is levelled and otherwise prepared for irrigation, preferably before settlement takes place.

Finally the Committee suggests that any interest of the Dominion Government in the colonization of the proposed development be provided for under the terms of a special agreement between the Dominion and the Province of Alberta.

Respectfully submitted.

ST. MARY AND MILK RIVERS WATER DEVELOPMENT COMMITTEE.

VICTOR MEEK, *Chairman,*
Controller, Dominion Water and Power
Bureau, Ottawa. Designated by the
Minister of Mines and Resources.

GEORGE SPENCE,
Director of Prairie Farms
Rehabilitation, Regina.
Designated by the Minister
of Agriculture.

WILLIAM HUNTER,
Accounts Branch, Department
of Finance, Ottawa.
Designated by the Minister
of Finance.

OTTAWA, February 16, 1942.

TABLES

TABLE I.—ST. MARY RIVER—UNITED STATES' SHARE AND UTILIZATION

In Acre-feet, November–October
1922–1940

Year	Natural Flow of St. Mary River	United States' Share	Diverted ⁽¹⁾ to Milk River	Waste	Per cent of Share Used
1922.....	626,500	258,700	67,940	190,760	26.6
1923.....	630,700	253,800	82,520	171,280	32.5
1924.....	571,600	229,200	91,280	137,920	39.8
1925.....	801,400	335,900	140,400	195,500	41.8
1926.....	421,500	148,700	100,100	48,600	67.3
1927.....	1,013,000	440,500	50,300	390,200	11.4
1928.....	848,500	359,800	72,300	287,500	20.1
1929.....	493,300	195,300	102,000	93,300	52.2
1930.....	587,900	235,800	89,920	145,880	38.1
1931.....	412,200	153,600	134,100	19,500	87.3
1932.....	599,500	244,200	158,000	86,200	64.7
1933.....	711,700	294,900	150,600	144,300	51.1
1934.....	796,300	341,600	164,500	177,100	51.8
1935.....	604,100	247,800	158,900	88,900	64.1
1936.....	444,600	172,500	154,100	18,400	89.3
1937.....	534,500	217,000	141,600	75,400	65.2
1938.....	637,100	262,800	163,200	99,600	62.1
1939.....	466,700	181,700	163,600	18,100	90.0
1940.....	412,000	151,800	132,700	19,100	87.4
Mean.....	611,300	248,700	122,000	126,700	49.0

(1) The amounts in this column are computed from the flow records at St. Mary Crossing gauging station on the diversion canal.

TABLE II.—ST. MARY RIVER—CANADA'S SHARE AND UTILIZATION

In Acre-feet, November–October
1922–1940

Year	Natural Flow of St. Mary River	Canada's Share	Used	Waste	Per cent of Share Used
1922.....	626,500	367,800	176,800	191,000	48.1
1923.....	630,700	376,900	192,200	184,700	51.0
1924.....	571,600	342,400	185,400	157,000	53.8
1925.....	801,400	465,500	181,400	284,100	39.0
1926.....	421,500	272,800	159,800	113,000	58.6
1927.....	1,013,000	572,700	122,600	450,100	21.4
1928.....	848,500	488,700	106,200	382,500	21.7
1929.....	493,300	298,000	101,600	196,400	34.1
1930.....	587,900	352,100	158,300	193,800	45.0
1931.....	412,200	258,600	185,900	72,700	71.9
1932.....	599,500	355,300	168,300	187,000	47.4
1933.....	711,700	416,800	183,200	233,600	44.0
1934.....	796,300	454,700	163,700	291,000	36.0
1935.....	604,100	356,300	165,400	190,900	46.4
1936.....	444,600	272,100	148,900	123,200	54.7
1937.....	534,500	317,500	191,300	126,200	60.2
1938.....	637,100	374,300	185,000	189,300	49.4
1939.....	466,700	285,000	149,200	135,800	52.4
1940.....	412,000	260,200	175,700	84,500	67.5
Mean.....	611,300	362,600	163,200	199,300	45.0

NOTE.—Approximately 14,500 acre-feet of the reported waste is for riparian rights on St. Mary River, at 20 c.f.s.

TABLE III.—ST. MARY AND MILK RIVERS—UNITED STATES' AND CANADA'S TOTAL SHARE AT INTERNATIONAL BOUNDARY.

In Acre-feet, November–October
1922–1940

Year	Natural Flow Milk River International Boundary	United States' Share	Canada's Share	Total Flow St. Mary and Milk Rivers	Total Share St. Mary and Milk Rivers U.S.	Total Share St. Mary and Milk Rivers Canada
1922.....	88,540	61,720	26,820	715,040	320,420	394,620
1923.....	83,570	59,500	24,070	714,270	313,300	400,970
1924.....	76,340	53,400	22,940	647,940	282,600	365,340
1925.....	125,000	83,780	41,220	926,400	419,680	506,720
1926.....	40,550	25,300	15,250	462,050	174,000	288,050
1927.....	393,100	241,200	151,900	1,406,300	681,700	724,600
1928.....	257,200	162,600	94,600	1,105,700	522,400	583,300
1929.....	164,100	107,700	56,400	657,400	303,000	354,400
1930.....	137,300	87,050	50,250	725,200	322,850	402,350
1931.....	43,000	27,590	15,410	455,200	181,190	274,010
1932.....	87,500	54,830	32,670	687,000	299,000	388,000
1933.....	105,200	74,030	31,170	816,900	368,930	447,970
1934.....	120,200	77,760	42,440	916,500	419,360	497,140
1935.....	97,240	61,450	35,790	701,340	309,250	392,090
1936.....	65,210	40,960	24,250	509,810	213,460	296,350
1937.....	92,750	65,320	27,430	627,250	282,320	344,930
1938.....	112,400	75,580	36,820	749,500	338,380	411,120
1939.....	45,100	29,460	15,640	511,800	211,160	300,640
1940.....	68,800	43,760	25,040	480,800	195,560	285,240
Mean.....	116,000	75,400	40,600	727,300	324,100	403,200

TABLE IV.—ST. MARY AND MILK RIVERS—UNITED STATES' TOTAL SHARE AND UTILIZATION

In Acre-feet, November–October
1922–1940

Year	United States' Total Share(?)	United States Diversion from Milk River	United States Wasted	Per cent of Share Used
1922.....	320,420	108,530	211,890	33.9
1923.....	313,300	101,200	212,100	32.3
1924.....	282,600	132,100	150,500	46.7
1925.....	419,680	154,500	265,180	36.8
1926 ⁽¹⁾	174,000	no record	no record	
1927 ⁽¹⁾	681,700	no record	no record	
1928.....	522,400	116,850	405,550	22.4
1929.....	303,000	204,400	98,600	67.4
1930.....	322,850	183,420	139,430	56.8
1931.....	181,190	159,070	22,120	87.9
1932.....	299,000	212,940	86,060	71.2
1933.....	368,930	193,010	175,920	52.3
1934.....	419,360	223,670	195,690	53.3
1935.....	309,250	223,970	85,280	72.4
1936.....	213,460	168,830	44,630	79.1
1937.....	282,320	212,170	70,150	75.2
1938.....	338,380	172,190	166,190	50.9
1939.....	211,160	134,000	77,160	63.4
1940.....	195,560	177,560	18,000	90.8
Mean 17 years.....	311,900 ⁽¹⁾	169,300	142,600	54.3

⁽¹⁾ Years 1926 and 1927 not included in averages.⁽²⁾ In addition to its share of St. Mary and Milk Rivers the United States had available water from tributaries of Milk River wholly in Montana.

TABLE V.—ST. MARY AND MILK RIVERS—CANADA'S TOTAL SHARE AND UTILIZATION

In Acre-feet, November–October
1922–1940

Year	Canada's Share St. Mary and Milk Rivers	Used by Canada St. Mary River	Wasted by Canada	Per cent of Canada's Share Used
1922.....	394,620	176,800	217,820	44.8
1923.....	400,970	192,200	208,770	47.9
1924.....	365,340	185,400	179,940	50.7
1925.....	506,720	181,400	325,320	35.8
1926.....	288,050	159,800	128,250	55.5
1927.....	724,600	122,600	602,000	16.9
1928.....	583,300	106,200	477,100	18.2
1929.....	354,400	101,600	252,800	28.6
1930.....	402,350	158,300	244,050	39.3
1931.....	274,010	185,900	88,110	67.8
1932.....	387,970	168,300	219,670	43.4
1933.....	447,970	183,200	264,770	40.9
1934.....	497,140	163,700	333,440	32.9
1935.....	392,090	165,400	226,690	42.2
1936.....	296,350	148,900	147,450	50.3
1937.....	344,930	192,100	152,830	55.7
1938.....	411,120	185,000	226,120	45.0
1939.....	300,640	149,200	151,440	49.6
1940.....	285,240	175,700	109,540	61.6
Mean.....	403,200	163,200	240,000	40.5

NOTE.—Canada has used less than 5 per cent of its share of Milk River.

TABLE VI.—DEFICIENCY OF WATER SUPPLY FROM ST. MARY RIVER FOR EXISTING IRRIGATION PROJECTS

Year and Month	Canada's Share St. Mary Available net c.f.s.	Irrigation Demand 98,400 ac. c.f.s.	Shortage c.f.s.	Shortage Acre- feet	Per cent of Full Legal Duty	Per cent of Full Duty 3 Mos.	Per cent of Full Duty for Year
1927							
July.....	1,543	820	.....	.....	100.0		
August.....	774	547	.....	.....	100.0		
September.....	892	273	.....	.....	100.0	100.0	100.0
1928							
July.....	1,434	820	.....	.....	100.0		
August.....	594	547	.....	.....	100.0		
September.....	353	273	.....	.....	100.0	100.0	100.0
1929							
July.....	772	820	48	2,880	94.2		
August.....	338	547	209	12,540	61.8		
September.....	188	273	85	5,100	68.9	79.2	87.5
1930							
July.....	769	820	51	3,060	93.8		
August.....	353	547	194	11,640	64.5		
September.....	244	273	29	1,740	29.4	83.3	90.0

TABLE VI.—*Concluded*

Year and Month	Canada's Share St. Mary Available net c.f.s.	Irrigation Demand 98,400 ac. c.f.s.	Shortage c.f.s.	Shortage Acre-feet	Per cent of Full Legal Duty	Per cent of Full Duty 3 Mos.	Per cent of Full Duty for Year
1931							
July.....	533	820	287	17,220	65.0		
August.....	394	547	153	9,180	72.0		
September.....	318	273			100.0	75.9	83.9
1932							
July.....	842	820	000		100.0		
August.....	410	547	137	8,220	75.0		
September.....	200	273	73	4,380	73.3	88.7	92.5
1933							
July.....	1,221	820					
August.....	516	547	31	1,860	94.4		
September.....	339	273			100.0	100.0	99.0
1934							
July.....	714	820	106	6,360	87.1		
August.....	371	547	176	10,560	67.8		
September.....	212	273	61	3,660	77.7	79.0	87.5
1935							
July.....	895	820			100.0		
August.....	429	547	118	7,080	78.4		
September.....	260	273	13	780	95.3	96.8	95.3
1936							
July.....	544	820	276	16,560	66.4		
August.....	284	547	263	15,780	51.9		
September.....	158	273	115	6,900	57.9	60.1	76.0
1937							
July.....	841	820			100.0		
August.....	324	547	223	13,380	59.3		
September.....	194	273	79	4,740	71.0	82.9	89.0
1938							
July.....	948	820			100.0		
August.....	351	547	196	11,760	64.1		
September.....	240	273	33	1,980	88.0	93.9	91.7
1939							
July.....	671	820	149	8,940	81.8		
August.....	314	547	233	14,000	57.4		
September.....	189	273	84	5,040	69.3	71.6	83.0
1940							
July.....	500	820	320	19,200	61.0		
August.....	257	547	290	17,400	47.0		
September.....	289	273			100.0	63.8	77.8

Total July shortage for 1927—1940=74,220 ac. ft.
Average July shortage =5,301.4 ac. ft. 10.8 per cent
Total August shortage for 1927—1940=133,380 ac. ft.
Average August shortage = 9,521 ac. ft. 29.0 per cent
Total September shortage for 1927—1940=34,320 ac. ft.
Average September shortage =2,451.4 ac. ft. 15.0 per cent
1939
Shortage July = 8,940 ac. ft.
August =13,980 ac. ft.
September= 5,040 ac. ft.

TABLE VII.—ESTIMATE OF OPERATION AND MAINTENANCE COSTS DURING DEVELOPMENT PERIOD.

Construction Year	1	2	3	4	5	6	7	8	9
	Investment in Structures of Estimated Life 30 Years	Replacements and Repairs (1/30 value)	Maintenance on Permanent Structures, Reservoirs etc. Allow	Cost of Operation of New Districts Not Yet Paying (\$1 per acre)	Operating Costs Delivering Water to Paying Districts (40c. per acre)	Districts Paying Acres	Revenue from Districts at 50c. Per Acre Plus Power	Total Cost = Sum of 2, 3, 4 and 5	Difference Between 7 and 8 = Annual Deficit
	\$	\$	\$	\$	\$		\$	\$	\$
5th.....	885,000	29,500	10,000	24,598	48,000	(¹)120,000	60,000	112,098	52,098
6th.....	983,000	32,800	16,000	51,759	48,000	120,000	(²)87,000	148,559	61,559
7th.....	1,375,000	45,800	16,000	69,585	57,800	144,598	99,300	189,185	89,885
8th.....	1,808,000	60,300	21,000	83,845	68,700	171,759	112,880	233,845	120,965
9th.....	2,040,000	68,000	25,000	80,605	85,600	214,183	134,092	259,205	126,113
10th.....	2,115,000	70,500	27,000	77,598	102,300	255,604	(³)197,803	277,398	79,595
11th.....	2,275,000	75,800	34,000	61,811	118,000	294,788	217,395	289,358	71,963
12th.....	2,303,000	76,800	36,500	53,789	133,300	333,202	236,602	300,389	63,787
13th.....	2,400,000	80,000	36,500	61,811	142,500	356,346	248,174	320,811	72,637
14th.....	2,400,000	80,000	36,500	54,898	154,800	386,991	263,497	326,188	62,691
15th.....	2,400,000	80,000	36,500	45,710	167,200	418,057	279,080	328,410	50,330
16th.....	2,400,000	80,000	36,500	23,121	176,800	441,879	290,941	316,420	25,480
17th.....	2,400,000	80,000	36,500	1,133	185,500	463,867	301,935	303,133	1,198
18th.....	2,400,000	80,000	36,500	nil	186,000	465,000	302,500	302,500	nil
Totals.....	.....	.....	.....	690,000	.....	.....	2,831,199	3,708,499	877,301

(1) Existing Districts—120,000 acres.

(2) Includes estimated net revenue of \$27,000 from Chin Power Plant.

(3) Includes estimated net revenue of \$44,000 from East Pothole Power Plant.

TABLE VIII.—POPULATION IN AREAS OF PROPOSED ST. MARY AND MILK RIVERS DEVELOPMENT.

Municipal Units	Area in Square Miles	1901	1906	1911	1916	1921	1926	1931	1936
Bow Island No. 64.....	208	13	66	1,352	1,061	990	537	603	614
Porty Mile No. 64.....	318	.....	9	1,383	1,456	1,585	1,118	1,080	1,148
Eureka No. 65.....	408	64	147	1,344	1,170	1,320	1,779	1,148	1,190
Total Rural Population.....	.....	77	222	4,079	3,687	3,895	2,434	2,811	2,952
Town Bow Island.....	.....	.....	.....	307	320	427	299	314	308
Town Burdett.....	.....	.....	.....	.....	95	182	112	121	90
Town Grassy Lake.....	.....	.....	.....	247	185	161	110	(disorg anized)	398
Total Urban Population.....	.....	.....	.....	554	600	770	521	435	398
Totals.....	384	77	222	4,633	4,287	4,665	2,955	3,246	3,550
Population per square mile.....	.....	0.08	0.24	4.96	4.59	4.99	3.16	3.48	3.59
I.D. No. 5 Milk River E.....	324	34	69	743	949	852	876	1,097	1,251
I.D. No. 6 Milk River W.....	324	13	84	381	605	426	482	678	643
I.D. No. 35 Skiff.....	324	31	1	87	74	311	215	307	430
I.D. No. 36 Warner.....	453	8	110	777	823	946	1,131	1,427	1,808
Total Rural Population.....	.....	86	264	1,988	2,451	2,535	2,704	3,509	4,132
Town of Milk River.....	.....	.....	.....	.....	.....	181	211	350	326
Town of Warner.....	.....	.....	.....	321	310	281	313	342	309
Total Urban Population.....	.....	.....	.....	321	310	462	524	692	635
Totals.....	1,425	86	264	2,309	2,761	2,997	3,228	4,201	4,767
Population per square mile.....	.....	0.06	0.18	1.62	1.93	2.10	2.26	2.95	3.34
I.D. No. 67 Lethbridge.....	404	140	535	1,544	2,125	3,126	3,470	4,691	4,635
Population of Medicine Hat.....	.....	1,570	3,020	5,680	9,272	9,634	9,536	10,300	9,592
Population of Lethbridge.....	.....	2,072	2,313	8,050	9,436	11,097	13,489	13,489	13,523

TABLE IX.—IRRIGATION DEVELOPMENT IN ALBERTA.

Project	Source of Supply	Miles of Canals at 1940	Area in Tract acres	Irrig. (1) Area acres	Area Actually Irrigated in Acres				
					1936	1937	1938	1939	1940
Canada Land & Irr. Co.	Bow River.	215.47	200,000	40,000	24,453	27,355	30,326	31,616	32,475
New West Irr. Dist.	Bow River.	24.0	8,000	4,500	2,207	2,752	3,000	3,368	3,189
C.P.R. Western Sect.	Bow River.	893.0	800,000	54,000	44,614	50,866	35,775	11,647	20,134
A.R. & I. Lethbridge.	St. Mary River.	219.0	200,000	84,000	75,274	75,250	75,749	76,492	76,639
Magrath Irr. Dist. (2) . . .	St. Mary River.	90.0	18,873	7,000	4,000	4,000	4,000	3,700	4,000
Raymond Irr. Dist. (2) . . .	St. Mary River.	16.0	20,520	15,100	13,000	13,000	12,000	12,000	13,000
Taber Irr. Dist. (2)	St. Mary River.	103.6	33,200	21,500	19,123	21,206	20,880	18,485	21,391
Eastern Irr. Dist.	Bow River.	2,028.0	1,500,000	150,000	111,781	124,645	133,928	141,688	138,462
Leth. North. Irr. Dist.	Oldman River.	600.0	220,782	95,000	62,790	70,020	73,297	56,712	72,492
United Irr. District.	Belly River.	175.0	62,800	34,000	18,000	17,500	10,000	10,000	10,500
Little Bow Irr. Dist.	Highwood River.	2.5	10,014	200	200	20	12	15	25
Mountain View Irr. Dist.	Belly River.	25.0	6,400	3,500	2,900	3,500	3,500	3,200	3,000
		4,391.57	3,080,589	508,800	378,342	410,204	402,467	368,923	395,307

Private Schemes (595)—irrigable area, 69,561 acres.

(1) This figure is based on the area actually served by works in operation.

(2) These three districts are served through the A.R. and I.

APPENDIX A

TEXT OF THE ORDER IN COUNCIL, P.C. 682, SETTING UP THE ST. MARY AND MILK RIVERS WATER DEVELOPMENT COMMITTEE

P.C. 682

PRIVY COUNCIL, CANADA

Certified to be a true copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 17th February, 1941.

The Committee of the Privy Council have had before them a report dated 15th January, 1941, from the Minister of Mines and Resources, representing, with the concurrence of the Secretary of State for External Affairs, the Minister of Finance, and the Minister of Agriculture, as follows,—

(1) Article VI of the Boundary Waters Treaty of 1909 between Canada and the United States provided for the apportionment between the two countries, for the purposes of irrigation and power, of the waters of the St. Mary and Milk Rivers and their tributaries (in the State of Montana and the provinces of Alberta and Saskatchewan).

(2) On October 4, 1921, the International Joint Commission made an order, pursuant to Article VI of the Treaty, providing in detail for the apportionment of the said waters between the two countries.

(3) On October 6, 1921, the International Joint Commission made a recommendation which read, in part:—

“The Commission finds, as a result of a very thorough investigation of the possibilities of irrigation development in those portions of the State of Montana and the Provinces of Alberta and Saskatchewan capable of irrigation by the waters of the St. Mary and Milk Rivers and their tributaries, that the quantities of land in this international region susceptible of development far exceed the capacity of the rivers in question even under the most exhaustive system of conservation. It is therefore of the utmost importance, not only because of the practical benefits to accrue to the people of this western country, but still more because the St. Mary and Milk Rivers problem is one that might easily become a source of serious irritation and misunderstanding to the people of the two countries, that every effort should be made to obtain the maximum efficiency in irrigation from these waters”

“It is therefore ordered that the following recommendations be respectfully submitted to the Governments of the United States and Canada;

That the Governments of the United States and Canada enter into an agreement for the construction of a reservoir at St. Mary Lakes in Montana.

That the Reclamation Service of the United States proceed with the construction of the proposed Chain-of-Lakes Reservoir in Montana, and the Canadian Reclamation Service with the proposed Verdigris Coulee Reservoir in Alberta.

That all reservoirs herein mentioned be constructed, controlled, and operated in the manner, for the purpose, and subject to the conditions above set forth.”

(4) The United States had completed the Chain-of-Lakes Reservoir referred to. The other two reservoirs have not been built. So far as the interests of Canada are concerned, it appears that it would be preferable to have a reservoir on the St. Mary River at Spring Coulee, Alberta, instead of the recommended reservoir at St. Mary Lakes in Montana, and to have a reservoir at what is known as the Forks Site, in Alberta on the Milk River, instead of the recommended reservoir at Verdigris Coulee.

(5) Representations have been received by the Canadian Government from the Government of Alberta, the South Alberta Water Conservation Council, and others, urging that the Canadian Government proceed immediately with the construction of the further storage and irrigation works required to use fully Canada's share of the St. Mary and Milk Rivers as apportioned under the Commission's Order of October 4, 1921.

(6) The proposals have been given a preliminary examination by the Dominion Water and Power Bureau.

(7) As a result of that examination it is considered expedient that a thorough examination be made by a committee representing the interested departments of the Canadian Government and the Province of Alberta.

The Committee therefore, on the recommendation of the Minister of Mines and Resources, concurred in by the Secretary of State for External Affairs, the Minister of Finance, and the Minister of Agriculture, advise that:—

1. A Committee be hereby established to be known as the St. Mary and Milk Rivers Water Development Committee, consisting of:

Mr. Victor Meek, Controller, Dominion Water and Power Bureau, Ottawa, designated by the Minister of Mines and Resources;

Mr. George Spence, Director of Prairie Farm Rehabilitation, Department of Agriculture, designated by the Minister of Agriculture;

Mr. W. E. Hunter, Accounts Branch, Department of Finance, Ottawa, designated by the Minister of Finance.

The representative of the Dominion Water and Power Bureau shall act as chairman of the committee.

2. The Government of Alberta shall be invited to appoint or designate one or more persons to work with the committee, of which they will not be members.

3. The expenses of each member of the committee be borne by the Department of which he is an officer. General expenses that cannot be properly met by the Dominion Departments concerned will be provided for in the votes of the Dominion Water and Power Bureau. The expenses of the persons appointed or designated by the Government of Alberta will not be borne by the Canadian Government.

4. The committee shall make a thorough study of all aspects of the proposals that further storage and irrigation works be built in Canada on the St. Mary and Milk Rivers. Without limiting the generality of the foregoing, the committee shall consider the following matters:—

(a) The water supply in Canada's share of international streams in Southern Alberta, the water requirements of the presently constructed projects and water available for further irrigation development.

(b) The most feasible plan to put these waters to beneficial use, including selection of lands to be irrigated, estimates of cost of storage reservoirs and other works required for complete development.

(c) Construction program with annual estimated expenditure over the period of years required to complete full development.

- (d) The arrangements necessary with the owners of the present irrigation projects and the owners of the further lands to be irrigated.
 - (e) The benefits which this water development would confer on Canada, the Province of Alberta and the residents of the districts affected.
 - (f) The allocation of costs and methods of financing.
 - (g) The administrative control to be exercised over the projects after completion, including maintenance and operation of the works constructed and colonization of the irrigable lands.
5. The committee shall not hold public hearings. With that limitation, it may invite and receive representations, in person or in writing or both, from interested bodies and individuals.
6. The committee may invite the co-operation of Departments of the Canadian Government not represented thereon. In particular, the committee shall invite the co-operation of the Department of External Affairs in dealing with international aspects of the proposals.
7. The committee shall, not later than a year from the date it is appointed, present a comprehensive report to the Minister of Mines and Resources, for transmission to the Governor in Council.

All of which is respectfully submitted for Your Excellency's approval.

(Sgd.) A. D. P. HEENEY,

Clerk of the Privy Council.

APPENDIX B

LIST OF PERSONS WHO ATTENDED ONE OR MORE OF THE MEETINGS HELD BY THE COMMITTEE

Meetings held at: Ottawa, March 12, 17, 19, 1941; Calgary, April 29, 1941; Lethbridge, May 1 and 2, 1941; Inspection trip of irrigation projects, September 17 to 21, 1941; Calgary, December 8, 9, 10, 1941; Ottawa, February 9 to 20, 1942.

List of persons who attended one or more meetings held by the St. Mary and Milk Rivers Water Development Committee:—

Representing the Government of the Province of Alberta: Honourable D. B. MacMillan, Minister in charge of Water Resources and Irrigation, Edmonton; Honourable N. E. Tanner, Minister of Mines and Resources, Edmonton; P. M. Sauder, Director of Water Resources, Edmonton.

Others in attendance: Carl Anderson, Irrigation Farmer and Former Chairman Board of Trustees Eastern Irrigation District, Scandia, Alberta; Chester Asplund, Official Trustee United Irrigation District, Glenwoodville, Alberta; Samuel Ashton, Dry Land Farmer and Member of the South Alberta Water Conservation Council, Burdett, Alberta; P. Baker, Irrigation Farmer and Chairman of the South Alberta Water Conservation Council, Raymond, Alberta; J. H. Blackmore, M.P., Lethbridge, Alberta; Honourable Senator W. A. Buchanan, Lethbridge, Alberta; L. C. Charlesworth, General Manager, Eastern Irrigation District, Brooks, Alberta; C. S. Clendenning, District Manager, Lethbridge Northern Irrigation District, Lethbridge, Alberta; J. Coke, Economic Division, Dominion Department of Agriculture, Ottawa; F. G. Cross, Superintendent, Lethbridge Section Canadian Pacific Railway Irrigation Project, Lethbridge, Alberta; J. W. Evans, Secretary-Treasurer, Raymond Irrigation District, Raymond, Alberta; L. E. Fairbairn, Secretary, South Alberta Water Conservation Council, Lethbridge, Alberta; Dr. W. H. Fairfield, Superintendent, Dominion Experimental Station, Lethbridge, Alberta; G. A. Gaherty, Chairman of the Committee on Western Water Problems of the Engineering Institute of Canada and President of the Montreal Engineering Company, Montreal; Ray Galvin, Dry Land Farmer and Member of the South Alberta Water Conservation Council, Burdett, Alberta; A. Griffin, Assistant Manager and Chief Engineer, Department of Natural Resources, Canadian Pacific Railway, Calgary; D. W. Hays, Manager of the Canada Land and Irrigation Company, Medicine Hat, Alberta; S. Houlton, Member South Alberta Water Conservation Council and Manager of the Smith Irrigation Farms, Lethbridge, Alberta; G. N. Houston, Consulting Engineer, Olds, Alberta; H. G. Long, Managing Editor, Lethbridge *Herald*, Lethbridge, Alberta; J. I. McDermott, Member South Alberta Water Conservation Council, Lethbridge, Alberta; C. J. McGavin, Chief Engineer, Water Rights Branch, Department of Natural Resources, Regina, Saskatchewan; A. Peterson, Irrigation Farmer Eastern Irrigation District, Scandia, Alberta; S. G. Porter, Manager, Department of Natural Resources, Canadian Pacific Railway, Calgary; W. D. Porter, Economic Division, Dominion Department of Agriculture, Edmonton; Roi Risinger, Dry Land Farmer and Member of the South Alberta Water Conservation Council, Lethbridge, Alberta; Andrew Stewart, Professor, Department of Political Economy, University of Alberta, Edmonton; Seymour Smith, Irrigation Farmer and Rancher, and Official Trustee of the Mountain View Irrigation District, Mountain View, Alberta; G. L. Stringham, Rancher, Milk River, Alberta;

T. Sundal, Secretary-Treasurer, Taber Irrigation District, Taber, Alberta;
T. Geo. Wood, Manager, Canadian Sugar Manufacturers Co. Ltd., Raymond,
Alberta; Wm. Valgerdson, Chairman, Board of Trustees, Taber Irrigation
District, Irrigation Farmer and Fieldman for the Beet Sugar Company; Dr.
F. A. Wyatt, Professor of Soils, University of Alberta, Edmonton.

APPENDIX C

SUMMARY OF RELIEF EXPENDITURES
SASKATCHEWAN AND ALBERTA

The necessity for supplying food, clothing, and shelter to needy persons and of making provision for live stock is as old as the history of our country. Dr. E. W. Stapleford in his "Report on Rural Relief in Western Canada", published in 1939, indicated that as early as 1737 the Governor of New France sent a request to France for flour and food. Since that time at various intervals assistance in the feeding and clothing of people and the supplying of feeds for live stock has been required. Seed grain and seeding supplies have also been necessary. However, the problem did not become serious in the West until after the effects of expansion due to the opening of a new country had passed and the impetus given to agriculture by the First Great War had worn off.

But during 1929 and the succeeding years' drought, insect plagues, and disease in the form of rust wrought havoc with production of grain crops. Prior to this time drought and insects had struck in smaller and more isolated areas but in these later years we have had severe and extensive disasters. Coupled with these difficulties prices for farm produce fell to such low levels that it became impossible for great numbers of our rural as well as urban populations to carry on.

It would be well to mention here that drought and adverse climatic conditions brought on soil drifting, erosion, and deterioration to such an extent as to permanently injure some soils and thus make it practically impossible for the farmer to ever work out his problems unassisted.

To assist farmers of the West, since 1929 vast sums of money have been expended by Municipal, Provincial, and Federal Governments. Expenditures to alleviate the effects of the problem created by these adverse conditions fall into three groups. These might be enumerated as follows:—

1. Direct contributions in cash or kind to provide food, clothing and shelter for persons, their live stock and to allow them to carry on their farming operations.
2. Debt cancelling and adjustment policies.
3. Work-for-wages programs and assistance to agriculture through cattle marketing policies, P.F.R.A. and P.F.A.A. policies.

DIRECT RELIEF AND AGRICULTURAL AID

Saskatchewan

Direct contributions have reached staggering sums in some years and would still be necessary if other policies affecting the problem had not been put into effect. Various methods and policies have been adopted in the three western provinces to meet the situation in each province so that in order to know what has actually taken place it is perhaps best to deal with each province separately. Since the effect of the proposed St. Mary and Milk Rivers Development would be felt mainly in Saskatchewan and Alberta it would be as well to confine ourselves to these two provinces. With this in mind we will first look at the situation in Saskatchewan.

The submission by the Government of Saskatchewan to the Royal Commission on Dominion-Provincial Relations devotes considerable space to the

subject of relief. It is from this submission that the information and figures quoted are taken. When the problem first presented itself various policies were introduced but as the problem became aggravated in size, due to greater areas being affected by drought and in intensity due to the prolonged nature of the drought, other methods and policies were found necessary. To even recite all of these would be an onerous task, would make this report unwieldy and would serve no particular purpose in dealing with the main topic now under discussion. The following table will suffice to illustrate the various forms of assistance given and the expenditures entailed in the carrying out of these policies in the rural areas of Saskatchewan from 1931 to 1937.

GOVERNMENT EXPENDITURES ON RURAL RELIEF IN SASKATCHEWAN
FROM SEPTEMBER 1, 1931, TO AUGUST 31, 1937

(From a Submission by the Government of Saskatchewan to the Royal Commission on Dominion-Provincial Relations)

	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37
	\$	\$	\$	\$	\$	\$
<i>Direct Relief—</i>						
Food.....	2,797,919	999,235	2,935,014	3,603,538	2,039,753	4,914,799
Fuel.....	1,538,239	695,384	1,248,623	1,521,718	1,054,421	1,630,060
Clothing.....	978,133	306,122	754,721	855,491	553,692	1,130,780
Medical Aid.....	91,053	20,264	124,471	192,972	264,537	358,471
Coal for Schools.....		11,431	38,409		34,060	90,820
Sundry.....	22,472	2,217	361,062	1,010,664	755,152	964,470
Total Direct Relief.....	5,427,816	2,034,653	5,462,300	7,184,383	4,701,615	9,089,430
<i>Agricultural Aid—</i>						
Seed and Seeding Operations.....	5,318,271	735,152	3,734,802	6,565,748	3,346,747	4,092,428
Feed and Fodder.....	5,094,716	519,860	2,984,970	5,917,598	159,004	5,118,554
Freight on Feed and Fodder.....	1,682,393		837,058	1,363,786	122,743	492,193
Freight—Miscellaneous.....	302,175		36,650	163,780		64,911
Grazing Fees.....	117,273			19,313		3,270
Binder Twine.....	798,028			32,177	171,589	
Grasshopper Bait.....			450,712	50,725	5,223	46,000
Total Agricultural Relief.....	13,312,856	1,255,012	8,044,192	14,113,127	3,805,306	9,817,356
TOTAL RELIEF.....	18,740,672	3,289,665	13,506,492	21,297,510	8,506,921	18,906,786

It should be pointed out before leaving the above table that the year 1937-38 far outstripped other years in the amount of money expended. While definite figures covering the above items are not available it is known that they were approximately \$50,000,000.

Alberta

The situation in Alberta has been comparable to that in Saskatchewan although the problem has not been so severe. The fact that Alberta has other resources has been of great assistance and the comparatively large areas of irrigated land have had the effect of absorbing a considerable number of men who would otherwise have been unemployed. The sugar beet and other specialized crops requiring a considerable amount of hand labour have been of great value in decreasing unemployment. The problem has been a serious one, however, and has been even more prolonged than in Saskatchewan.

"The Case for Alberta", Alberta's Submission in connection with Dominion Relations 1938, discusses this problem and it is from this report that we have the following information.

The year 1914 was very dry in southeastern Alberta and as a result the Dominion Government supplied food, seed grain and fodder to residents of that part of the province. The same thing occurred in 1917 and the Provincial Government met the appeal for assistance. Relief was required in this area in each of the years between 1918 and 1922. An increase in the amount of

rainfall in the area from 1922 to 1930 resulted in improved crop yields and thus eliminated the necessity for relief in those years. In 1931 and in succeeding years relief has been required in all its forms until 1938.

The following table indicates the amount of agricultural aid provided between 1917 and 1937. It will give some idea of the services rendered and by whom the costs were met.

STATEMENT SHOWING AGRICULTURAL AID (FOR YEARS 1917 TO 1937 INCLUSIVE)

	Total Expenditure	Net Provincial Expenditure	Reimburse- ments from Dominion Government
	\$ cts.	\$ cts.	\$ cts.
Administration.....	471,390 43	457,459 40	13,931 03
Freight on Feed and Seed.....	760,580 33	411,052 64	349,527 69
Movement of Settlers.....	352,393 94	190,865 12	161,528 82
Purchase of Drought Area Cattle.....	40,247 49	40,247 49	.....
Purchase of Potatoes and Vegetables.....	594 63	594 63	.....
Wintering Horses.....	3,967 50	3,967 50	.....
Freight on Drought Area Cattle.....	40,636 13	24,962 30	15,673 83
Freight on Feed Prov. Area, 1936-37.....	48,300 43	48,300 43	.....
Feed and Fodder Losses Prov. Area, 1936-37.....	17,810 38	17,810 38	.....
Sub-Total.....	1,735,921 26	1,195,259 89	540,661 37
SPECIAL DOMINION AREA 1936-37			
Feed and Fodder Relief.....	1,032,456 39	18,839 05	1,013,617 34
Freight on Processing Cattle.....	103,154 97	42,986 55	60,168 42
Sub-Total.....	1,135,611 36	61,825 60	1,073,785 76
Total Drought Area.....	2,871,532 62	1,257,085 49	1,614,447 13
Relief Settlement Plan.....	361,743 60	121,421 16	120,407 36
Grand Total.....	3,233,276 22	1,378,506 65	1,734,854 49

NOTE.—Reimbursement from Municipalities amounted to \$119,915.08.

Direct relief costs have also reached staggering sums as is indicated by the following table. This statement prepared by the Bureau of Relief and Public Welfare covers relief costs for the period from March, 1931 to March, 1938 inclusive.

STATEMENT SHOWING DIRECT RELIEF COSTS FOR THE PERIOD
MARCH, 1931, TO MARCH, 1938, INCLUSIVE

RELIEF WORKS	Gross
Year ended March 31, 1931.....	\$ 2,263,195 64
1932.....	4,426,941 46
1933.....	1,866,333 11
1934.....	389,606 49
1935.....	953,442 77
1936.....	663,665 81
1937.....	1,448,125 15
	<hr/>
Estimated year ended March, 31, 1938.....	\$12,011,310 43
	1,102,713 01
Total	<hr/> \$13,114,023 44 <hr/>
DIRECT RELIEF	
Year ended March 31, 1931.....	\$ 298,144 05
1932.....	1,886,638 99
1933.....	2,874,932 56
1934.....	3,573,835 17
1935.....	3,524,689 18
1936.....	4,492,505 06
1937.....	5,133,694 23
	<hr/>
Estimated year ended March 31, 1938.....	\$21,784,439 24
	4,795,154 24
Total	<hr/> \$26,579,593 48 <hr/>
ADMINISTRATION	
Year ended March 31, 1931.....	\$ 17,401 69
1932.....	34,159 66
1933.....	93,082 08
1934.....	149,466 80
1935.....	146,138 03
1936.....	161,678 28
1937.....	169,906 54
	<hr/>
Estimated year ended March 31, 1938.....	\$ 771,833 08
	173,300 06
Total	<hr/> \$ 945,133 14 <hr/>
MEDICAL AND HOSPITALIZATION	
Year ended March 31, 1931.....	\$ 84,284 19
1932.....	86,982 02
1933.....	117,538 56
1934.....	154,914 49
1935.....	155,959 39
1936.....	234,207 95
1937.....	218,728 26
	<hr/>
Estimated year ended March 31, 1938.....	\$ 1,052,614 86
	277,220 67
Total	<hr/> \$ 1,329,835 53 <hr/>
RECAPITULATION	
Relief works	\$13,114,023 44
Direct relief	26,579,593 48
Administration	945,133 14
Medical and hospitalization	1,329,835 53
	<hr/>
Total Provincial expenditure	\$41,968,585 59
	<hr/>
Indigent and hospitalization services in organized territories not contributed to by the Dominion Government.....	\$10,000,000 00
	<hr/>
Grand total	\$51,968,585 59

DEBT CANCELLING AND ADJUSTMENT POLICIES

Saskatchewan

Debt adjustment and cancellations effected in Saskatchewan have covered the fields of first mortgages, agreements for sale, tax arrears and relief costs.

In 1928 an Act was passed setting up the Provincial Debt Adjustment Board. This Board commenced in 1933 acting as intermediary between debtors and creditors in the voluntary adjustment of debts. Before legal proceedings for debt collection were instituted the creditor was compelled to obtain the permission of the Debt Adjustment Board. Debt adjustments amounting to \$1,000,000 were reported by the end of the year 1936.

By the end of 1936 the problem had become so intense that a Voluntary Debt Adjustment Office was set up. The scope of the work of this office covered three types of debts.

1. First mortgages and agreements for sale.
2. Tax indebtedness.
3. Relief.

By February, 1938 this office had been instrumental in obtaining a reduction of interest rates on farm contracts to six per cent. Adjustments had been effected as follows:—

Mortgage and agreement for sale indebtedness.....	\$27,050,000
Tax arrears	23,000,000
Relief debts	32,000,000
Total	<u>\$82,050,000</u>

Adjustments under this arrangement were all voluntary so in order to force unreasonable creditors to accept a settlement the Farmers' Creditors' Arrangement Act, 1934, was passed by Federal Parliament.

Alberta

Before going on to a discussion of the operations of this Act voluntary adjustments in Alberta might be discussed. The Farmers' Creditors' Arrangement Act applies in both provinces.

In Alberta debt adjustment legislation has been on the statutes of the Province since 1914. The problem became acute in 1921 and the Drought Area Relief Act of 1922 provided that sufficient of the crop produced in that year could be retained by the farmer to provide seed and feed, and maintenance for himself and family until the 1923 crop could be harvested.

In 1923 the Drought Area Relief Act was superseded by the Debt Adjustment Act. Under this Act a Board was set up to act as arbiter between creditor and debtor. This Act continues in force until the present time. No figures are available as to the amount of debts adjusted under this arrangement.

As stated before, the Farmers' Creditors' Arrangement Act was passed in 1934 by Federal Parliament. Under this Act Boards of Review were set up in each province to review the individual cases of debt and to enforce a settlement. By 1937 four thousand cases had been reviewed and reduction of over \$10,000,000 had been brought about in Saskatchewan alone. Again no figures are available for Alberta.

WORK FOR WAGES

In the earlier years of depression a road work program was carried out at a cost of approximately \$4,000,000 to the province.

In Alberta, timber and tie contracts were given to needy settlers and as a result 468 families were assisted in one year alone.

Single unemployed were assisted to the extent of \$5 per month if they worked on a farm. This amount was increased by \$2.50 per month where the labourer stayed throughout the winter until April 1. The farmer who employed the labourer was reimbursed to the extent of \$5 per month. Dominion and Provincial Governments contributed equally to this scheme.

The following table gives the number of persons assisted in each year and the cost of the plan to the Governments:—

	Saskatchewan	Cost
1931-32	7,937 persons	\$ 282,190 28
1932-33	6,723 "	132,356 00
1932 (summer months)	362 "	3,135 79
1933-34	9,660 "	179,676 16
1934-35	5,492 "	78,362 03
1935-36	6,371 "	104,331 11
1936-37	27,898 "	1,652,770 11
1937-38 (incomplete)	27,066 "	1,846,000 00
		<u>\$4,278,821 48</u>

Alberta
Farm Help Unemployment Relief Plan

	No. of Placements	Cost
1932-33	1,276	\$ 5,659 90
1933-34	1,509	11,118 07
1934-35	1,662	11,724 58
1935-36	2,948	42,826 19
1936-37	6,095	171,809 58
Nov. 1, 1937, to Feb. 26, 1938.....	5,222	131,213 00
		<u>\$ 374,351 32</u>

In two of the worst drought years cattle marketing policies were put into effect. In 1936 low grade or poorer quality cattle were disposed of to the packers on the basis of one cent per pound. Freight charges and handling were paid for by the Governments.

In the autumn of 1937 a much more ambitious scheme for the marketing of live stock of all types and grades was put into effect. Under this scheme cattle were assembled at Carberry, Manitoba. Here they were sorted and sold by auction. The scheme worked very satisfactorily. Nearly 90,000 head of cattle were disposed of by this one scheme alone. It has been estimated that in this one year 474,000 cattle were taken out of the area affected by drought. Many of these were moved to areas where feed was obtainable through "feeder-freight" policies. The total cost to the Government of this program was \$340,000.

In 1935 the Prairie Farm Rehabilitation Act was passed by Federal Parliament. Under this Act various methods for assisting the farmer, not only in an immediate financial way, but in devising means of combating drought and the evils attending drought, were brought into being. Cultural methods for the control of soil drifting and insect pests were introduced. Seeding of crested wheat grass and other grasses and forage crops was advocated. Tree planting as a means of soil drift control as well as for shelter belts for home and gardens was recommended. Lands found to be submarginal were taken out of cereal production and converted into community pastures by removing and resettling the farmers located on this submarginal land. Water conservation projects by the construction of dams and dugouts on individual farms for the purpose of providing water for domestic and irrigation purposes have been constructed. Larger community water development projects have been built for the purpose of producing forage for live stock. Last, but by no means least, technical studies in soils and economics have been undertaken to obtain information which

can be used as the basis of further methods of attacking the various problems arising out of the difficulties caused by drought. Under P.F.R.A. approximately \$12,000,000 has been spent in various activities.

In 1939 an Act was passed by Federal Parliament known as the Prairie Farm Assistance Act. The purpose of this Act was to provide a means of eliminating direct relief. Assistance is paid to farmers who reside in townships where the average yield is less than 12 bushels of wheat per acre. The amount paid is based on three categories. Where the yield is 0 to 4 bushels per acre the farmer receives a payment of \$2 per acre; where the yield is more than 4 bushels and not more than 8 bushels the payment is \$1.50 per acre; if the average yield in the township is more than 8 bushels per acre and under 12 bushels per acre payment is made on the basis of \$1 per acre. Limits are set, depending on the year, as to the amounts which a farmer can collect.

The following tables give the amounts of money expended in Prairie Farm Assistance Act payments since 1939.

1939-40 P.F.A. PAYMENTS AS AT JULY 31, 1940

Category	Manitoba		Saskatchewan		Alberta		Total All Provinces	
	Twps.	Farmers	Twps.	Farmers	Twps.	Farmers	Twps.	Farmers
0- 5.....			260	8,034			260	8,034
0- 4.....	14	440			42	395	56	835
4- 8.....	51	2,251	302	9,444	147	2,021	500	13,716
8-12.....	91	4,269	621	21,984	395	9,726	1,107	35,979
Total.....	156	6,960	1,183	39,462	584	12,142	1,923	58,564
Total Payments...	\$868,942.11		\$7,434,424.27		\$1,600,934.39		\$9,904,300.77	

1940-41 P.F.A. PAYMENTS AS AT SEPTEMBER 30, 1941

Category	Manitoba		Saskatchewan		Alberta		Total All Provinces	
	Twps.	Farmers	Twps.	Farmers	Twps.	Farmers	Twps.	Farmers
0- 4.....	5	204	143	3,943	22	206	170	4,353
4- 8.....	37	1,096	343	11,314	70	967	450	13,377
8-12.....	129	5,048	774	25,535	125	3,045	1,028	33,628
Total.....	171	6,348	1,260	40,792	217	4,218	1,648	51,358
Total Payments...	\$608,361.30		\$5,592,496.83		\$492,253.77		\$6,693,111.90	
Average per farmer							\$130.33	

This summary of relief in Alberta and Saskatchewan is perforce brief and somewhat sketchy. To tell the whole story would require much space and in the main would prove to be a doleful tale. Any reasonable scheme to eliminate the need for relief should meet with the approval of not only Governments but of those who have had to ask for assistance through no fault of their own.

REGINA, January 28, 1942.

APPENDIX D

PROVINCIAL LEGISLATION FOR SETTING UP IRRIGATION DISTRICTS

BY P. M. SAUDER

The constitution of irrigation districts is similar to that of large school and municipal districts. They are created under the Irrigation Districts Act, which provides for the formation of irrigation districts as follows:

"An irrigation district may consist of one tract of land or several isolated tracts of land, but no district, whether formed or continued under the provisions of this Act, shall include or continue to include, as the case may be, any minerals the ownership of which is vested in some person other than the owner of the surface, superadjacent thereto, nor, in the case of minerals leased by the owner of the surface, such minerals during the continuance of the lease.

"A petition for the formation of any irrigation district may be forwarded to the Minister.

"The petition shall define the content of the proposed district by setting out the quarter sections (or where a quarter section is owned by more than one owner the smaller parcels comprised therein which belong in their entirety to one owner) to be comprised therein.

"The petition shall be signed by corporations or by persons who have attained the age of twenty-one years and who are collectively the owners of at least one-half of the proposed district.

"The petition shall be in form A in the schedule hereto and be accompanied by a statutory declaration as therein particularized.

"Where it is more convenient; there may be several statutory declarations.

"Any owner may sign the petition by an agent duly authorized thereunto in writing.

"The petition shall further be accompanied by a sum of money sufficient in the opinion of the Minister to constitute an expense fund to defray all expenses properly incurred (prior to the formation of the district or the refusal of the Minister to form the same) in carrying out the directions contained in this Act, or in taking any step rendered necessary or proper thereby; or, at the option of the Minister by a bond in a sum sufficient to cover the said expenses.

"The petition shall further be accompanied by evidence satisfactory to the Minister of the feasibility of operating the proposed district as an irrigation district, which evidence shall be or include the report thereon of an engineer who is, in the opinion of the Irrigation Council, qualified to make the same.

"Within one month after a petition in proper form has been received and the requirements of the preceding section have been complied with, the Minister shall cause a notice to be published in the *Alberta Gazette* stating that application has been made for the formation of an irrigation district as therein described and shall in the notice give the proposed district a name.

"A like notice shall be published by the petitioners not less than once a week for three consecutive weeks in a newspaper of general circulation within the proposed district and named by the Minister.

"If at the expiration of two weeks from the last publication of the newspaper notice no substantial objection to the formation of the proposed district has been made, the Minister shall appoint a returning officer for the purpose of taking a vote as to the formation of such district and for the election of a board.

"The Minister shall be sole and uncontrolled judge as to whether any objection is of a substantial nature or not.

"The board of every district shall consist of three trustees who shall be:—

- (a) water users of the district;
- (b) of the full age of twenty-one years;
- (c) British subjects.

"Matters preparatory to any such election and proceedings thereat and consequent thereon shall be regulated by the provisions of Part II of this Act.

"At any time prior to the appointment of a returning officer, as hereinbefore provided for, the Minister may make such changes either by exclusion or inclusion in the content of the proposed district as he may deem proper and just.

"The effect of any alteration in the content of any district by the Minister shall be to substitute the district as so altered for the district as originally proposed in the petition.

"At any time prior to the appointment of a returning officer as hereinbefore provided, if in the opinion of the Minister it is desirable so to do, he may direct that no further proceedings be taken toward the formation of the district, and he shall at the same time make such direction as may be proper for the disposal of so much of the deposit made pursuant to section 6 as remains unexpended.

"If the statement as to the result of the election made by the returning officer to the Minister under the provisions of Part II of this Act shows that two-thirds of the persons voting were in favour of the formation of the district, the Minister, subject to the provisions of Part II of this Act as to irregular or improper conduct of elections and corrupt practices thereat and as to recounts, shall by order form the land described in the petition into an irrigation district and shall therein declare the names of the trustees thereof, nominating any trustee or trustees that may be required to complete the proper number.

"The order forming such irrigation district shall set forth:

- (a) the name in full, situation and content thereof;
- (b) the date and places at which the election was held;
- (c) the names of the trustees and their post office addresses in order of votes given for them, or, where there has been no voting, alphabetically.

"Such order shall be published by the Minister within one month in the *Alberta Gazette*.

"After such publication the validity of the formation of the district and the election of trustees shall not be questioned in any Court or in any way whatsoever, and notwithstanding any want of compliance with the terms of this Act, the district shall be deemed to have been formed, and the trustees to have been elected, as validly as if all the terms of this Act had been complied with."

The Act makes the Board of Trustees a body corporate and gives it power to conduct the affairs and business of the district subject in certain respects to the approval of an Irrigation Council appointed by the Provincial Government to advise every Board upon the conduct of the affairs of its district, and who may forbid any act or course of conduct proposed to be done or entered upon by a Board.

The Act provides for the retirement of a portion of the Board each year and the prompt filling of vacancies. Only water users have a vote and are eligible to become members of the Board of Trustees. The Lieutenant Governor-in-Council may at any time and from time to time appoint an official trustee to conduct the affairs of any district, who shall be deemed to be the Board and shall have all the powers and authorities possessed by the Board or its officers.

The assessment roll is compiled by the secretary of an irrigation district, assisted by the district engineer, as soon as possible after the formation of the district. The assessment roll shows the ownership of all the irrigable lands in the district and is the basis for making the levies to raise the necessary funds for the district.

Funds for the construction of new works may, with the approval of the Irrigation Council, be obtained by the Board of Trustees of a district by selling debentures.

Funds for the maintenance and operation of the works are raised by levying a water service charge on all irrigable lands shown on the assessment roll. The principal and interest payable under the terms of the debentures is met by a water right charge also made on all of the irrigable lands.

There is provision in the Act for the district to become the owner of lands where the rates levied by the Board of Trustees are not paid. These lands are then sold to provide funds to pay the arrears of rates and to obtain a water user who is more likely to be able to pay the rates.

Provision is made in the Act for expropriating the land for right-of-way for works when the Board of Trustees considers that the compensation demanded by the owner is excessive. Provision is also made for changing the content of a district when circumstances warrant it.

The Water Resources Act declares the ownership of all surface water in the Province of Alberta vested in the province. Persons and corporate bodies wishing to divert water for irrigation must file applications in proper form with the Director of Water Resources. When certain conditions are fulfilled and the works constructed, the applicant is granted a licence which gives him legal authority to divert water with priority according to the date of his application compared with the dates of the other applicants on the same stream and in the same drainage basin.

APPENDIX E

HISTORY OF IRRIGATION

BY D. W. HAYS

General Manager, Canada Land and Irrigation Company, Medicine Hat, Alberta

"According to Herodotus the whole country was studded with a 'vast number of great cities'. Cultivation depended on irrigation which was supplied by a large number of canals. Pliny and Berosus are eloquent on the subject of the agricultural wealth of the country. And Ammianus Marcellinus states that from the point reached by Julian's army to the shores of the Persian Gulf was one continuous forest of verdure." "The first public work Alexander the Great undertook in Babylonia was the construction of a new head on solid ground for the Hindia Branch or the Pallacopas."

These are quotations from a book entitled "The Irrigation of Mesopotamia," by Sir W. Willcocks, K.C.M.G., F.R.G.S., adviser to the Turkish Minister of Public Works, dated 1911. His report had to do with the irrigation of 5,000,000 hectares, i.e., 12,350,000 acres.

Mr. F. H. Newell, first Director of the United States Reclamation Service, stated:—

"Before historic times the practice of irrigation had been recognized to such an extent that rules relating to the handling of water were embodied in the earliest known writings. In the code of Hammurabi (2150 B.C.) it appears that provisions were made to cover troubles and controversies that are being met to-day. 'The early writings on the discovery and conquest of Mexico and South American countries casually mention the irrigation canals as a part of the features of the country.' 'In the southwestern portion of the United States, especially in Arizona and New Mexico, remains of irrigation works have been found which were constructed and operated prior to any recorded history of that section.' 'In 1847 irrigation was begun by the Mormon settlers in the Salt Lake Valley, Utah. This was the beginning of Anglo-Saxon irrigation in this country. The next irrigation development of any magnitude was about twenty years after work was started in Utah, when it was taken up in Colorado and California. From these parent colonies it gradually spread to the other states of the arid west.'"

These brief references are eloquent testimony of an age old institution. They are interesting in themselves as a brief background to a vast enterprise which has been developed in North America, largely in the past 60 years, in which period our present practice is directly concerned.

WATER RIGHTS

The history of irrigation is largely a history of water and the trials and tribulations, physical and legal, incidental to its use. Since soil and water are necessary to each other, for the purpose of agriculture in the arid regions, it follows that the right of both, vested in an individual was and is fundamentally essential. Land exists in abundance whereas water is limited either in volume or availability. Lands could be and were readily acquired by squatters' right, homestead law, script, etc., but in the arid west, habitation was dependent upon the ability to grow essential food for human use and forage for live stock. These essentials could not be secured saving by irrigation and the tenure of right to the use of water was primarily important.

Early developments were undertaken by the pioneers of the country, largely by individual effort, in diverting small streams of water to adjoining lands. Groups of individuals undertook larger works involving crude dams of rock and brush and ditches extending at greater length to neighbouring lands. The

Desert Land Act provided means for acquiring land under condition that the lands could be reclaimed by use of water taken from the stream and applied to the soil without return of water to the watercourse. This was largely contradictory to the policy of riparian ownership of water under the laws of the eastern and humid states where water was abundant and where no one was allowed to interfere with streams to the detriment of neighbours. But in the arid west it was recognized that lands could not be put to their best uses without taking water from the streams. From this there developed a recognized right of appropriation. A system, or better stated as a procedure of appropriations by recorded filings in county and state offices was put into use accompanied in some cases by posted notices of appropriation of water at proposed points of diversion.

Thus was founded the early right to the use of water but at best the availability and use of water when needed was hazardous. Spring floods destroyed dams, washed out and silted up ditches which had to be hurriedly repaired lest a rapidly dwindling flow of flashy streams should find the stream bed dry. As more settlers appeared more appropriations were recorded on already over-appropriated streams. Water became scarce. It was a case of those diverting water uppermost on the stream getting the largest share and for a longer period of time regardless of the fact that others, at points lower down the stream, had precedence in right by former use. There arose not only the question of right in volume but right in time about which in the confusion of records, administration, if any, could only apply in various degrees of inefficiency. A water right in these arid regions became man's most prized possession next only to his family. The home meant nothing without water. Out of this turmoil of repairing dams and ditches, beating the neighbours to the use of water, fights, court actions, and tribulations, the west got its start in irrigation. It is obvious that these conditions under which irrigation functioned could not continue.

Beginning in the late nineties and early years of 1900, definite steps were taken by the Federal and State Governments to bring order out of chaos; also, in the interests of national development, to ascertain the extent of water resources and by storage of water and regulation of distribution to consider the benefits not only to existing water users but the extent to which additional lands could be irrigated. Water resources were originally vested in the Federal Government primarily because of Federal ownership of the land, but method and procedure of appropriation had been left to local government. Central authority was required for which state tribunals were formed with the object of determining the then existing rights in time of priority and quantity. This involved extensive surveys and compilations of recorded filings of appropriations which were fantastic in the extreme. Recorded appropriations were in miners' inches, feet, second-feet, all the flow, enough to irrigate all the land, etc. These helped to fix early intentions and perhaps the date of early use but were of little practical value for determining quantities of water from time to time relatively with others, in the gradual development of use. A generally recognized rule was "that first in time was first in right" provided that the time could be confirmed by knowledge and testimony of the extent of beneficial use. Large quantities had been claimed according to the views of the original appropriators including perhaps their dreams of empire but the diligence in initiating and extending on the use of water was a matter for consideration. There also arose the question of superior claims in the use of water; for domestic purposes, for stock, for municipal use, for agriculture or the need for producing food, then for manufacturing or industrial purposes as less important than the requirements of food and drink. In time the various claimants were brought to a court of equity and out of records, testimony and the best recollections of the older inhabitants,

adjudications were made and authority created in the state for equitable distribution in the use of water. A major problem, vital to the well being of many thousands of people, was on the way to settlement.

In June, 1902, the Reclamation or Newlands Act was passed which stated, "that the right to the use of water acquired under the provisions of this Act shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure and the limit of the right."

The principle is generally accepted throughout the western states, in which the water right is established as a basic factor for irrigation. A Federal Departmental decision February 5, 1909, stated—"There can be no beneficial use of water for irrigation until it is actually applied to reclamation of the land. The final and only conclusive test of reclamation is production. This does not, perhaps, necessarily mean maturing of a crop but certainly does mean the securing of actual growth of a crop."

The actual joining of soil and water constitutes another phase of irrigation involving not only the medium by which works were to be financed, brought into being and paid for but also the actual construction of the works. These have passed through stages of trial and error, successes and failures, of which a long and colourful history could be written.

ORGANIZATION

Following early individual and small group developments, greater activities were undertaken by land owners with the object of better security in water supply, in unifying and reducing costs and for a better distribution of benefits. This manifested itself in the formation of Irrigation Districts which has to-day become the important form of organization for the ownership and operation of irrigation works.

The first irrigation district legislation appears to have been passed by Utah in 1865. That legislation provided that county clerks, on application of a majority of land owners in areas proposed to be irrigated, should create districts. A large number of districts were formed under this act but nothing was accomplished.

It is probable that the earlier and larger efforts in promoting irrigation districts occurred in California and a brief statement of organization efforts in that state will typify the general efforts elsewhere in the west.* The first California irrigation district law was passed in 1872 entitled "an act to promote irrigation." Details were lacking or were insufficient to effect proper administration and financing. The law was inoperative. A second irrigation district act was passed by the legislature of California in 1874. It was entitled "an act to promote irrigation in the county of Los Angeles." Various acts followed largely applicable to different counties each adjusting provisions, probably unworkable, of previous acts in effort to meet local conditions. In the light of present experience it is not surprising that nothing resulted in many of the early formed districts. Nevertheless the passage of these acts paved the way for improved legislation. The "Wright Act" was passed in 1887 and it is interesting to note that six irrigation districts out of a number formed under this Act are functioning, at least until recently. This Act was generally revised in 1897 and the law definitely designated as the "California Irrigation Act" by legislature in 1917. Various changes have since been required to meet local conditions here and there and important amendments made to the constitution of the state in the interests of irrigation districts. Various subservient acts have been passed under the headings:—County water districts, mainly for domestic purposes; Water districts by holders of title and may be organized within an irrigation district; Muni-

* Bulletin No. 21 "Irrigation Districts in California"—by Frank Adams.

cial improvement districts, organized to distribute water; Water storage and water conservation districts and improvement districts within irrigation districts.

This brief chronicle is typical of the efforts made in the history of organization; a process of evolution out of which present laws and regulations have been made, no doubt still imperfect but workable.

Brief reference is made to the "Carey Act" passed August 18, 1894, by which the United States offered to each of the arid and semi-arid states one million acres of arid land under condition the state should cause the land to be reclaimed and settled by actual settlers. The state need not enter upon reclamation in the name of the state but authority was provided whereby irrigation works could be constructed by individuals, an association or company under agreement with the state subject to rules governing acquisition of water rights, plans for works, settlement and costs to settlers. Some developments were made under the Act the extension of which was no doubt handicapped at the time by questions of water supply and limited to the most cheaply built projects. This Act was followed by the Reclamation Act 1902.

The Reclamation Act passed 17th June, 1902, was "an act appropriating the receipts from the sale and disposal of lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

There were in sixteen states and territories over 535 million acres of public land of which a part was arid and it was estimated that 35 million acres could be profitably reclaimed by the construction of irrigation works. The cost was so large as to make development impossible for private enterprise. It was proposed that the proceeds arising from the sale of all public land in the 16 states and territories should constitute a trust fund for use in the construction of irrigation works, the cost of each project to be assessed against the land irrigated and as the money was paid by the land entrants back into the fund it was to be used for other lands. All irrigable lands were withdrawn from entry pending construction of works and then opened for entry under the homestead laws in farm units up to 160 acres.

The work of the U.S. Reclamation Service was largely the forerunner on this continent, of extensive irrigation development. It stimulated activity firstly in obtaining comprehensive laws and regulations pertaining to water rights and in putting to use methods of general procedure in engineering and agricultural investigations, surveys and plans for works. Since 1902 Federal development and investment by the Bureau of Reclamation and Office of Indian Affairs as at 31st December, 1939, provided for the irrigation of 3,791,120 acres at a cost of \$298,072,825. With work under construction by the Bureau of Reclamation as at June 30, 1941, the Federal Government will supply water to over 4,900,000 acres at an estimated cost of \$818,742,466. The total irrigable area in the United States including non-federal (private) enterprises, as at June 30, 1941, totals 27,179,146 acres at a total cost of \$1,545,025,535. It is estimated that over 50,000 farms and 250 towns have been created with a combined population of 900,000 people. When projects now under way are completed they will add another 2,500,000 acres on which an additional 800,000 or more people will live. During the existence of the Reclamation Service a total crop wealth of more than 2½ billion dollars has already been produced, equal to ten times the cost of construction for the irrigated lands from which the crops were obtained.

The Reclamation Act of 1902 provided that construction charges should be repaid by those who settle upon the reclaimed lands in equal annual instalments not to exceed ten. In 1914 an extension act provided that construction charges should be repaid in twenty years with provision that previous contracts could be converted to the 20-year plan. In 1924 an act provided for payment on a crop production basis as determined for a period of ten years. It was based on the average production capacity of the land and payment by each farmer was to be made not on his crop return for this particular farm, but on

the average return of the class to which his farm belonged. This Act was repealed in 1926 by substituting a 40-year repayment plan and authorized the Secretary of the Interior to enter into a contract with irrigation districts providing for payment of the cost of construction in a period not to exceed forty years.

In early years, projects having favourable facilities and low costs for works were first undertaken. As development extended, projects of greater cost per acre were built. In more recent years a policy of reimbursable and non-reimbursable costs has been put into effect under the provisions of the Case-Wheeler Act as amended October 14, 1940. This act authorized the Secretary of the Interior to utilize in such manner as the President may direct, services, labour, materials or other property including money, supplied by other Federal agencies, for which the United States shall be reimbursed in such amount as the President may fix for each project within the limits of the water users' ability to pay costs.

Recently nine projects were approved under this act and included, for the first time since the inauguration of the Federal irrigation policy through enactment of the Reclamation law of 1902, provision for rough levelling of land, farm ditches and definite plans for land use readjustments. The Bureau of Reclamation is responsible for construction facilities while land preparation and settlement plans are under the Department of Agriculture. These nine projects provide for the irrigation of 89,025 acres at an estimated cost of \$14,623,000 or at an average cost of \$164.26 per acre. Of this sum \$70.41 is reimbursable including \$16 per acre for land development and other activities of the Department of Agriculture. The remaining cost of \$93.85 is made up by allotments of labour and materials from Works Progress Administration and Civilian Conservation Corps, not generally reimbursable by the water users benefited.

The provisions of this act meet the multiple needs of improved utilization of land by irrigation, the rehabilitation of farms and farmers in the drought areas and by providing employment directed to creating an asset to the country, as compared with the losses which governments and individuals suffer through contributions of direct relief.

IRRIGATION IN CANADA

Irrigation in Canada is largely confined to developments in Alberta during the past thirty years or since about 1910. Up to 1920 irrigation work was undertaken almost entirely by private enterprise. Since 1920 a number of irrigation districts have been formed to irrigate lands in private ownership which had been previously farmed by dry farming methods. These districts were financed by sale of bonds in most cases guaranteed by the province.

Early irrigation practice in Company projects was greatly handicapped by slow settlement. Encouraged by occasional wet years and in spite of semi-arid conditions, settlers persisted with dry farming principally in the production of wheat as most drought resistant and for which a ready cash market was available; moreover irrigation was new to these settlers and land values high. But continued summer-fallow practice, winds, soil drifting and soil depletion coupled with dry years wrought havoc in large areas. Lands were abandoned. Many settlers moved to northern areas and some to irrigation districts. Those moving to irrigation districts were handicapped financially and lacked experience in irrigation but by determination and perseverance they have found succour and release from the hazards of dry farming in the drought areas. They have demonstrated the merits of irrigation. While wheat is still excessively grown, they are gradually turning to mixed farming by growing forage crops and by stock feeding, a valuable adjunct to prairie pasture lands, and by growing canning products, sugar beets, vegetables, etc. for market, berries and hardy

fruits for home use. They have found security, confidence and the opportunities for a comfortable farm home. They are creating a valuable asset in aiding to stabilize Canadian agriculture.

IRRIGATION DEVELOPMENT IN THE UNITED STATES

The following table shows irrigated acreage in 1939 reported for All Non-Federal (Private) Irrigation enterprises and for Federal (Bureau of Reclamation and Office of Indian Affairs) Projects in 17 Western States—also the Investments in Non-Federal (Private) and Federal Irrigation enterprises actually in operation in the 17 Western States as at 31st December, 1939.

	Area in Acres			Investments		
	Non-Federal (a)	Federal (b)	Total	Non-Federal (c)	Federal (d)	Total
				\$	\$	\$
Arizona.....	245,537	407,269	652,806	28,565,303	56,155,637	84,720,940
California.....	5,127,254	50,396	5,177,650	301,676,562	6,907,975	308,584,537
Colorado.....	3,117,599	103,086	3,220,685	93,210,072	13,639,271	106,849,343
Idaho.....	1,051,631	1,222,318	2,273,949	58,494,104	44,060,942	102,555,046
Kansas.....	99,980		99,980	2,153,886		2,153,886
Montana.....	1,385,040	311,023	1,696,063	26,465,309	40,118,625	66,583,934
Nebraska.....	352,978	257,401	610,379	24,396,397	14,659,810	39,056,207
Nevada.....	745,301	86,952	832,253	6,788,633	10,044,742	16,833,375
New Mexico.....	428,597	124,577	553,174	21,598,343	11,109,535	32,707,878
North Dakota.....	7,337	14,278	21,615	346,462	1,409,027	1,755,489
Oklahoma.....	3,826	334	4,160	182,531	89,655	272,186
Oregon.....	827,463	220,613	1,048,076	23,462,514	27,350,235	50,812,749
South Dakota.....	25,161	35,037	60,198	497,860	4,897,650	5,395,610
Texas.....	966,280	73,834	1,040,114	63,069,236	3,147,764	66,217,000
Utah.....	917,567	258,672	1,176,239	28,027,113	13,866,349	41,893,462
Washington.....	167,516	447,598	615,114	23,495,238	32,946,213	56,441,451
Wyoming.....	1,308,766	177,732	1,486,498	23,853,406	17,669,395	41,522,801
Total.....	16,777,833	3,791,120	20,568,953	726,283,069	298,072,825	1,024,355,894

Irrigation works under construction by the Federal Government as at June 30, 1941—increase the total irrigable area in the United States to 27,179,146 acres at a total estimated cost of \$1,545,025,535.

Records from U.S. Irrigation Census preliminary tabulation compiled by Information Division Research Section

Bureau of Reclamation—

(a) Excludes acreage Bureau of Reclamation.

(b) Bureau of Reclamation and Office of Indian Affairs.

(c) Investment in enterprises listed by Bureau of the Census as Individual, Co-operative Irrigation Districts, etc.

(d) Investment by Bureau of Reclamation and Office of Indian Affairs.

IRRIGATION DEVELOPMENT IN ALBERTA

The following table shows by projects, the acreage that can be irrigated by the works constructed to date in Alberta together with the cost of construction thereof as furnished by the Alberta Department of Water Resources.

Project	Irrigable Area	Cost of Construction
		\$
Canada Land and Irrigation Co.....	40,000	7,000,000
New West Irrigation District.....	4,500	210,000
C.P.R. Western Section.....	54,000	5,860,000
A.R. and I. Lethbridge.....	84,000	2,134,000
Magrath Irrigation District.....	7,000	200,000
Raymond Irrigation District.....	15,100	170,000
Taber Irrigation District.....	21,500	300,000
Eastern Irrigation District.....	150,000	13,000,000
Lethbridge Northern Irrigation District.....	95,000	5,400,000
United Irrigation District.....	34,000	550,000
Little Bow Irrigation District.....	200	20,000
Mountain View Irrigation District.....	3,500	30,000
Totals.....	508,800	34,874,000

In addition there are 595 small private projects to irrigate about 70,000 acres.

The projects as listed are capable of some enlargement by the extension of existing works.

APPENDIX F

GENERAL PLAN OF THE PROPOSED ST. MARY AND MILK RIVERS DEVELOPMENT
SHOWING SOURCES OF WATER SUPPLY, RESERVOIRS, MAIN CANALS
AND IRRIGABLE LANDS

**ST. MARY AND MILK RIVERS DEVELOPMENT
SHARABLE AREAS**

Area	Acres
St. Mary	1,000,000
Milk River	1,000,000
St. Mary & Milk River	1,000,000
St. Mary & Milk River & Snake River	1,000,000
St. Mary & Milk River & Snake River & Columbia River	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa & Australia	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa & Australia & Antarctica	1,000,000

**USE OF RESERVOIRS
IN RIVER BASIN DEVELOPMENT**

Name of Reservoir	Capacity CFS
St. Mary	1,000,000
Milk River	1,000,000
St. Mary & Milk River	1,000,000
St. Mary & Milk River & Snake River	1,000,000
St. Mary & Milk River & Snake River & Columbia River	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa & Australia	1,000,000
St. Mary & Milk River & Snake River & Columbia River & Pacific Ocean & Alaska & Canada & Mexico & Europe & Asia & Africa & Australia & Antarctica	1,000,000

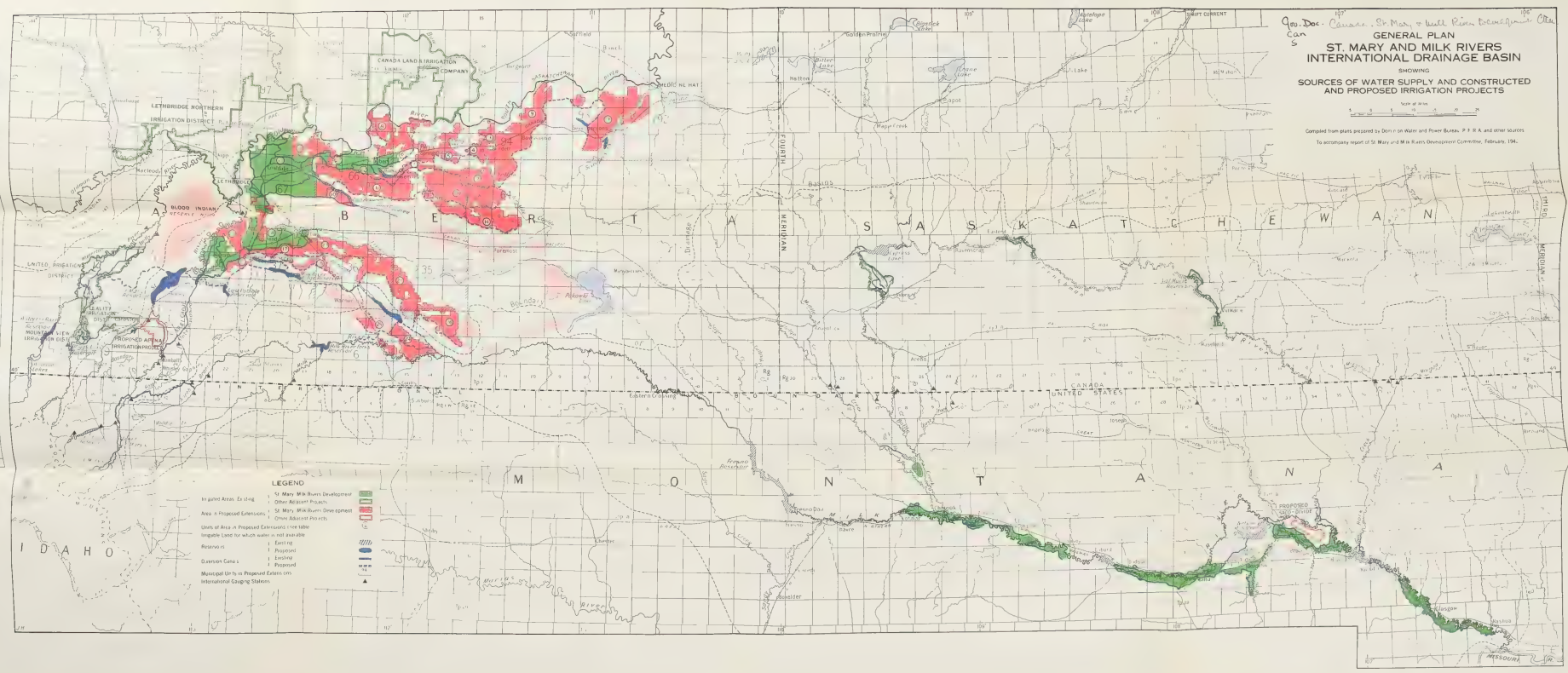
Gen. Doc. 447
Can 5

GENERAL PLAN ST. MARY AND MILK RIVERS INTERNATIONAL DRAINAGE BASIN

SHOWING
SOURCES OF WATER SUPPLY AND CONSTRUCTED
AND PROPOSED IRRIGATION PROJECTS

Scale of Miles
0 1 2 3 4 5 6 7 8 9 10

Compiled from plans prepared by Don in Water and Power Bureau, P. 3, 4, and other sources
To accompany report of St. Mary and Milk Rivers Development Committee, February, 1941.



LEGEND

- In gaged Areas: Existing
 - St. Mary Milk Rivers Development
 - Other Reservoir Projects
 - St. Mary Milk Rivers Development
 - Other Reservoir Projects
- Area in Proposed Extensions
 - St. Mary Milk Rivers Development
 - Other Reservoir Projects
- Units of Area in Proposed Extensions (see table)
- Integrable Land for which water is not available
- Reservoirs
 - Existing
 - Proposed
- Overseer Cuts
 - Existing
 - Proposed
- Municipal Limits in Proposed Extensions
- International Gauging Station



Gov.Doc.
Can
Com
S

Not access.
Canada. St.Mary and Milk Rivers Water
Development Committee
Report on further storage ... 1942.

**University of Toronto
Library**

**DO NOT
REMOVE
THE
CARD
FROM
THIS
POCKET**

Acme Library Card Pocket
LOWE-MARTIN CO. LIMITED

